Propositions found in the dissertation:

Unraveling Equivocality in Evaluations of Information Systems Projects

Arviansyah

October 21st, 2015

1. Equivocality hinders decision-makers to attain effective IS/IT project evaluations and purposeful decisions (Chapter 2).
2. Eight categories give rise to the emergence of equivocal situations in project evaluations: (1) Complexity of the process; (2) Sophistication of the technology; (3) Challenges encountered in project management; (4) Lack of evaluation standards; (5) Changes in the external state; (6) Different frames of reference among decision-makers; (7) The failure of evaluation methods; and, (8) Lack of evaluation data to support decision-making (Chapter 3).
3. The evaluation framework organizing the 'cause' categories of equivocality into Content, Context, and Process, provides an appropriate base to understand the emergence of equivocal situations and to develop an instrument to measure such situations as well as the causes (Chapter 3, 4, and 6).
4. Equivocal situations and the causes can be quantitatively measured and predicted (Chapter 5).
5. The 'Content' of the evaluation, comprised of the challenges encountered in project implementation, the establishment of evaluation criteria, and the involvement of novel concepts/technologies in the projects, is the salient driver of an equivocal situation (Chapter 6).
6. Differences exist between 'Public – Private sector', and 'High – Low ladder' projects on how the equivocal situations emerge when evaluating the projects (Chapter 7).
7. The doctoral journey underlines the necessity of becoming an independent researcher, 'from student to scholar'; you need to explore all avenues and paddle your own canoe.
8. The mixed methods approach requires extra time and effort without the promise of result convergence; it is essential to scrutinize whether the results are congruent or not.
9. Good pronunciation of 'equivocality' may take a while; the same can be said for 'dubbelzinnigheid'.

Unraveling Equivocality in Evaluations of Information Systems Projects

Arviansyah

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SYSTEMS PROJECTS

PROEFSCHRIFT

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Voor mijn moeder en mijn vader

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Enschede, October 2015

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Chapter 1. Introduction to the Research

1.1 Setting the Scene

To sustain their competitive advantage, organizations must acquire the ability to realize business value from information systems and technology (IS/IT) investments (Peppard and Ward 2004; Porter 1996). Virtually all organizations spend enormous amount on resources to develop their IS/IT and align them with the organizational strategy. It is reported that organizational investment expenditure has increased to 40-45% worldwide (Cha et al. 2009). Gartner predicts IS/IT expenditure will grow by 2.4% worldwide in 2015¹. The top five expenditure categories will be: security technology, cloud computing, business analytics, application developments/upgrades or replacements, and wireless/mobile technology, as forecast by the Computerworld². With the current pace of competition and technology, organizations are becoming more and more reliant on the success of their IS/IT portfolios and projects.

Yet, the numerous reports from both academics and practitioners paint a bleak picture of IS/IT project success rates; such endeavors are low (Charette 2005; Emam and Koru 2008; Eveleens and Verhoef 2010; Keil and Mähring 2010). Standish Group, via its well-known 2013 CHAOS Manifesto, shows a concerning number of IS/IT projects fail: 43% of projects are challenged, 18% cancelled and 59% of the projects exceed their initial budgets³. The figures are even more worrying regarding large projects. This means close to half of organizational spending is devoted to underperforming projects. Likewise, failures and their related costs in the “Software Hall of Shame” depicted by Charette (2005) shows the elusive challenge organizations encounter and the importance of improving IS/IT project execution. Despite the lack of clarity and the numerous questions raised on the Standish reports’ methodology, the conducted survey is too large to be neglected (Gingnell et al. 2013; Glass 2006). The phenomenon needs to be considered carefully as other similar reports exhibit worrying figures as well (Ashurst et al. 2008; Emam and Koru 2008; Eveleens and Verhoef 2010).

In the Netherlands, the issue has become a national concern. An investigation was instigated by the Dutch parliament between July 2012 and October 2014 to examine

¹<http://www.gartner.com/newsroom/id/2959717>(accessed March 2015)

²<http://www.computerworld.com/article/2840907/forecast-2015-it-spending-on-an-upswing.html> (accessed March 2015)

³ <http://www.versionone.com/assets/img/files/CHAOSManifesto2013.pdf> (accessed October 2014)

government IS/IT projects which had surpassed their budgets and repeatedly failed to meet the project schedules and requirements. The ten conclusions attributed this mostly to: management and governance flaws, government shortcomings, IS/IT project management drawbacks, and politicians' lack of awareness (www.houseofrepresentatives.nl)⁴. This lack of awareness concerns the rapid diffusion of IS/IT within government policy and public domain which then leads to inadequate involvement in and control of the projects. The report, which includes thirty four recommendations, urges the Dutch government to establish BIT (Bureau ICT-toetsing – ICT-Assessment Agency), an organization with the special task to evaluate and judge the chance of success of the governmental IS/IT projects and to be a projects' gatekeeper. Besides these recommendations, the report also highlights the BIT tasks to assess motions and bills as well as the importance of good communication between them and the House of Representatives, especially by increasing the 'ICT awareness'.

Prior to investing in information systems and information technology, IS/IT program management is carried out, so that the implementation can account for the organizational strategy (Lycett et al. 2004). This consists typically of several, often involves high-risk, projects known as large-scale and 'black swan' projects (Buhl 2012; Buhl and Meier 2011; Lee et al. 2012). Large-scale and 'black swan' projects are associated with the occurrence of rare and unpredictable events during project execution, which often turn out to be destructive (Buhl 2012). These projects are suspected of disrupting businesses and organizational activities and may spell disaster (Christensen and Overdorf 2000; Davenport 1998; Parent and Reich 2009). The issues of inadequate risk identification and mitigation, socio-political challenges, and a myriad of project dimensions (e.g., system novelty, stakeholder composition, and complex business-technical requirements) make IS/IT projects more susceptible to fiascos (Keil and Mähring 2010).

1.2 Motivation, Research Objectives and Questions

The aforementioned issues have drawn the attention of researchers in the information systems field for over a decade. Information systems and technology (IS/IT)

⁴ <http://www.houseofrepresentatives.nl/news/committee-presents-report-failures-government-ict-projects> (accessed October 2014)

projects refer to the development of information systems and technology solutions, embedded in organizational processes; the aim is to provide and fulfil the internal information processing needs of organizations (Ewusi-Mensah 1997). The projects serve as the instrument to realize the organizations' investments on information systems and technology (Savolainen et al. 2012). Given the complexity of IS/IT projects and the continuing challenges faced by organizations in attaining project objectives, researchers are particularly concerned with the decisions made during projects which 'take on a life of their own' (Buhl 2012; Buhl and Meier 2011; Lee et al. 2012).

Early studies coined the terms entrapment and escalation of commitment in relation to continuation decisions of particular endeavors (Brockner 1992; Whyte 1986). The phenomenon occurs when decision-makers are entrapped into committing additional resources to a failing course of action; current IS/IT studies often refer to this as project escalation (Lee et al. 2012; Wei et al. 2003). Projects which typically exceed the initial budget and schedule are allocated additional resources thereby draining the organizational resources continuously. Hence, a thorough evaluation is of the utmost importance to detect difficulties and to forewarn management of any potential fiascos during project execution (Pan et al. 2006). Based on the evaluation, organizations can revise the plans and business cases to be justifiable, hence maintaining adequate project returns and proceeding with well-positioned strategies.

Smithson and Hirschheim (1998a) refer to information systems evaluation as *"the assessment or appraisal of the value, worth or usefulness of an information system."* (p. 160). Ballantine and Stray (1998) consider appraisal and evaluation as part of the decision-making process and stress that the term 'evaluation' is often used in studies to denote the potentially different times or multiple points of evaluation. Regarding the multiple points of evaluation, Farbey et al. (1999), further echoed by Al-Yaseen et al. (2006), state that information systems and information technology evaluation is *"a process, or group of parallel processes, which take place at different points in time or continuously, for searching and for making explicit, quantitatively or qualitatively, all the impacts of an IT project and the programme and strategy of which it is a part"* (p. 190).

In this thesis, we are interested in the evaluation of projects that endeavor to implement information systems within organizations; specifically, the evaluation at the time of or during project execution. There is a discrepancy between the research on

evaluation and the practice of evaluation; especially, as only a few studies have focused on the evaluation of on-going projects (Al-Yaseen et al. 2006; Bernroider et al. 2013; Song and Letch 2012). We link the continuation decisions of IS/IT projects to project evaluations since these events are carried out to justify the choices of action, and thus the resulting decisions (Gunasekaran et al. 2006; Pan et al. 2006; Seddon et al. 2002). This is done by subscribing to Bowen's Decision Dilemma theory, using it as the theoretical glue, to bring together the issues of continuation decisions and project evaluations. The theory introduces and underlines the term 'equivocal information', which applies to information for which multiple (positive or negative) interpretations can be constructed (Bowen 1987). The notion of equivocality highlights the challenges encountered in IS/IT project evaluation as well as the dilemmas faced by decision-makers when deciding on the projects' next course of action.

There is a growing recognition of the relevance of equivocality in IS/IT projects. Prior research has attributed the common use of appraisal methods (i.e., capital budgeting techniques) as the major flaw of project continuation decisions affected by equivocality (Keil and Flatto 1999; Tiwana et al. 2006). The importance of equivocality in affecting continuation decisions is recognized as well in other fields. Equivocality is attributed to problematic evaluations; improper decisions can hamper decision-makers in achieving the objective of an evaluation (Bragger et al. 2003; Sleesman et al. 2012). Improvements in evaluation can be expected with reductions in equivocal situations; thus, decision-makers are able to formulate purposeful decisions and proceed with well-positioned strategies.

Despite this progress, our understanding of equivocality in IS/IT project evaluations remains primitive. The concept of equivocality in IS/IT projects has not been well-established yet and the antecedents of such a phenomenon have not been explored. This warrants exploration of the phenomenon and development of a premise that can lead to a better understanding of equivocal situations in IS/IT project evaluations as well as the causes of equivocality. The research objective is formulated as follows:

To understand the emergence of equivocality in evaluations, to develop a model of equivocal situation antecedents in IS/IT project evaluations, and to draw lessons learned from the findings.

This thesis aims to improve our conceptual understanding of equivocality in IS/IT projects by identifying typical characteristics of equivocal situations and investigating the causes of equivocality. We develop and assess an instrument to measure an equivocal situation and its causes in IS/IT project evaluations. We derive a model that captures the causes of equivocal situations; predicting the prevailing equivocal situations in the context of IS/IT project evaluations. We provide a glimpse into the emergence of equivocal situations and what decision-makers can do to forestall the problematic situations. This thesis endeavors to answer the main research question:

How does equivocality manifest in IS/IT project evaluation and what is its impact on evaluation?

Furthermore, the following sub-research questions are derived from the main research question:

1. How can equivocality be defined in IS/IT projects and what are the characteristics of an equivocal situation? (Chapter 2)
2. What are the causes of equivocal situations in IS/IT project evaluations? (Chapter 2 and 3)
3. How do equivocal situations emerge in practice? (Chapter 3 and 4)
4. How can an equivocal situation and its causes be measured? (Chapter 5)
5. What are the salient causes driving equivocal situations in IS/IT project evaluations? (Chapter 6)
6. What insights have to be taken into account by decision-makers before embarking on evaluations and making continuation decisions? (Chapter 6 and 7)

1.3 Research Strategy

1.3.1 Research Philosophy

In this part we discuss some influential research paradigms and theoretical streams in the information systems field. Chua (1986) states that researchers “*have shared and continue to share a constellation of beliefs, values, and techniques. These beliefs circumscribe definitions of “worthwhile problems” and “acceptable scientific evidence”*” (p. 602). Orlikowski and Baroudi (1991) continue by describing three sets of beliefs according to distinct and different research perspectives, based on how researchers are ‘seeing’ and ‘researching’ the world.

The first set of beliefs is about physical and social reality, also known as ontology. These beliefs are related to “*the essence of phenomena under investigation*” (objective and subjective assumptions), to the beliefs about “*human rationality*” (e.g., utility-maximizing), and to the beliefs about “*social relations*” (e.g., stable and orderly versus dynamic and conflictive social interaction) (Orlikowski and Baroudi 1991).

The second set of beliefs is about knowledge, also known as epistemology. These beliefs concern the notion of knowledge, which may be divided into epistemological and methodological assumptions (Chua 1986). These beliefs define how knowledge can be acquired and the criteria to construct and evaluate valid knowledge toward a phenomenon (Hirschheim 1985; Orlikowski and Baroudi 1991). Since epistemological assumptions are related to how truth is defined and what is acceptable as truth, the methodological assumptions will then usually be derived from epistemological assumptions (Chua 1986).

Three main epistemological categories in the information systems field are defined by Orlikowski and Baroudi (1991) as: positivism, interpretivism, and critical; Wareham et al. (2005) further added design science. Orlikowski and Baroudi (1991) explain that “*Positivist studies are premised on the existence of a-priori fixed relationships within phenomena which are typically investigated with structured instrumentation*” (p. 5) yet in contradiction, “*interpretivists asserts that reality, as well as our knowledge thereof, are social products and hence incapable of being understood independent of social factors (including the researchers) that construct and make sense of that reality*” (p. 13).

To distinguish critical from positivist and interpretivist paradigms, Orlikowski and Baroudi (1991) highlight “*While the other two research perspectives try to predict or explain the status quo, critical research is concerned with critiquing existing social systems and revealing any contradictions and conflicts that may inhere within their structure.*” Additionally, Hevner and Chatterjee (2010) describe design science as “*a research paradigm in which a designer answers questions relevant to human problems via the creation of innovative artifacts, thereby contributing new knowledge to the body of scientific evidence*” (p. 5).

Finally, the third set of beliefs is about the relationship between knowledge and the empirical world. These beliefs are related to “*the role of theory*” and “*what the researchers intend to achieve in the studies*” (Orlikowski and Baroudi 1991). Although research in the information systems field can be derived from particular underlying philosophical assumptions or beliefs, Orlikowski and Baroudi (1991) argue that a study may not be restricted to a single research perspective. Lee (1991) proposes a framework that integrates positivist and interpretive paradigms, in which researchers can justify the sequential or simultaneous utilization of a wide-ranging method within both approaches to decipher the research problems and questions. This means that one can bring together the different research perspectives during different stages of a study.

1.3.2 Research Design and Approach

Venkatesh et al. (2013) describe the ‘mixed methods’ term as “*the third methodological movement (paradigm).*” Mixed methods, which usually combine the different philosophical assumptions, are considered to be superior to a single method design (Venkatesh et al. 2013). On facing the limitations inherited by a single quantitative and qualitative method design, Venkatesh et al. (2013) comment that “*a mixed methods approach provides an opportunity for IS researchers to be engaged in rich theory development processes, such as bracketing, breakdown, and bridging*” and provides “*the opportunity to develop novel theoretical perspectives*” (p. 48-49). Academics widely support the approach, for instance, Kaplan and Duchon (1988) outline the benefit of triangulation by combining qualitative and quantitative methods. They state that “*using multiple methods increases the robustness of results because findings can be strengthened through triangulation – the cross-validation achieved when different kinds and sources of data converge and are found congruent, or when an explanation is developed to account for all the data when they*

diverge.” (p. 575). Ammenwerth et al. (2003) highlight specifically the benefit of applying triangulation in evaluation studies. Triangulation can be applied by combining or using different methods, measures, sources of data, investigators, or even different theories (Greene and McClintock 1985; Talmon et al. 2009). Gable (1994) describes and discusses in detail how qualitative case studies can be combined with a quantitative survey. Creswell (2003) contributes a special chapter on the mixed methods approach in his book along with the well-known qualitative and quantitative research methods.

We employ two study phases by following the well-established research methodologies. The study is designed using mixed methods to overcome unique limitations at each phase and to corroborate and triangulate the findings resulting from the use of different data and method types. Figure 1 illustrates the research design; it shows the phases and the utilized methods. The deployment of methods in the first phase may seem sequential and rigid; yet, the methods in the exploration and theory development are connected to each other as an iterative process (Eisenhardt 1989). This will be recapped and elaborated on in Chapter 6. Additionally, it is worthy to note that mixed methods require a great amount of time and effort. The endeavor to acquire a number of interviews and survey samples is not easy as this study is aimed at IS/IT project professionals who are typically busy and have very tight schedules. This includes designing the interview and the questionnaire as simply and concisely as possible yet motivating the informants/participants enough to join the study.

Phase 1: Exploration; theory and model development			Phase 2: Theory and model testing		
Domain establishment; constructs and measurement identification			Model development, specification and validation		
Literature review (2 databases)	Interviews with experts (7 interviews)	Case studies (4 projects – 10 interviews)	Pilot survey (N=33)	Survey & PLS analysis (N=111)	Post hoc analysis (N=111 and 6 interviews)
Chapter 2	Chapter 3	Chapter 4	Chapter 5	Chapter 6	Chapter 7

Figure 1. Thesis research design, approach and structure

Furthermore, it is important to note that this thesis includes chapters based on stand-alone papers; most of them have been peer-reviewed as conference and journal publications. The original stand-alone manuscripts have similar or shared backgrounds, motivation, and theoretical foundations, which means that some repetitions may exist in this thesis; after Chapter 2, the other chapters can be read independently. For the sake of conciseness and clarity, the manuscripts have been edited and arranged into the current order to portray the ‘evolution’ of the thesis. The connection and the flow of the chapters within the thesis are depicted in Figure 1. A brief overview of the chapters is described in the following section.

1.4 Structure of the Thesis

The thesis is organized into a total of 8 chapters, including an introduction and an epilogue. Chapter 2 starts with exploring the extant literature related to equivocality and continuation decisions by means of a systematic review. This chapter identifies typical characteristics of equivocal situations and synthesizes the literature to form categories of equivocal situation causes. The analysis and findings from the literature review are discussed. An initial framework drawn from the extension of the content, context, and process (CCP) and the conceptual practice model of evaluation (CPME) is built for further analysis and modeling (see Figure 2).

Next, Chapter 3 presents an examination of equivocality in IS/IT project evaluation by means of interviewing experts who have experience with project execution and evaluation. The initial framework is used as a guide and is refined based on the discussions with experts. This chapter highlights the experts’ perceptions of and opinions on an equivocal situation and its causes, to corroborate and refine our earlier work. Then, Chapter 4 extends the prior examination and investigates the emergence of equivocal situations in practice through multiple project cases. Multi-perspectives within a project are obtained with an initial description of issues and problems related to equivocality and an initial conception of equivocal situation causes. These are used to form an applicable instrument.

Figure 2. Developing the initial framework

Furthermore, Chapter 5 outlines the development process and the qualitative and quantitative assessment of an instrument to measure equivocal situations in IS/IT project evaluation; the results are discussed in detail. The instrument is employed in further steps and Chapter 6 highlights the utilization of the mixed-method research to develop and test our premise. This is mainly to compensate for the limitations of our prior steps and to complement our theoretical development. The findings are meant to demonstrate early evidence of equivocal situations and their causes. Chapter 7 aims to identify and to gain more insights on the salient causes of equivocal situations in IS/IT project evaluation, especially how people cope with equivocality and its causes through post hoc interviews. Finally, Chapter 8 concludes the thesis. It starts by recapping the research questions and giving a summary of the research findings. Then, the contributions of the research are presented and discussed as well as the limitations and implications. Potential further research is suggested and a final remark is given to conclude the thesis. In addition to this Ph.D. thesis, the following deliverables are the results of the research:

Table 1. Research presentations and publications

1	Arviansyah, A., Spil, T., and Hillegersberg, J. v. under revision. "Improving IS/IT Project Continuation Decisions: The Role and Causes of Equivocality in Evaluations," <i>Business & Information Systems Engineering</i> .	Chapter 2
2	Arviansyah, A., Spil, T., and Hillegersberg, J. v. 2013. "Evaluating IS/IT Projects: Revealing the Causes of Equivocality," <i>17th Pacific Asia Conference on Information Systems, PACIS 2013</i> , Jeju, Korea.	Chapter 3
3	Arviansyah, A., Spil, T., and Hillegersberg, J. v. 2013. "Evaluating IS/IT Projects: Emergence of Equivocality in Practice," <i>Americas Conference on Information Systems, AMCIS 2013</i> , Chicago, IL, United States, pp. 1480-1492. (Best paper award)	Chapter 4
4	Arviansyah, A., Spil, T., and Hillegersberg, J. v. 2014. "Equivocality in IS/IT Project Evaluation: Model Development and Pilot Study," <i>Procedia Technology</i> (16), pp. 1155-1165. Arviansyah, A., Spil, T., and Hillegersberg, J. v. 2015. "Development and assessment of an instrument to measure equivocal situation and its causes in IS/IT project evaluation," <i>International Journal of Information Systems and Project Management</i> , (3:3), pp. 25-45.	Chapter 5
5	Arviansyah, A., Spil, T., and Hillegersberg, J. v. forthcoming. "To Continue or Discontinue the Project, That is the Question," <i>International Conference on Information Systems, ICIS 2015</i> , Fort Worth, TX, United States.	Chapter 6
6	Arviansyah, A., ter Halle, Y., Spil, T., and Hillegersberg, J. v. 2015. "Project Evaluation: A Mixed-Method Study into Dilemmas in Continuation Decisions," <i>Hawaii International Conference on System Sciences, HICSS 2015</i> , Kauai, HI, United States, pp. 4436-4445.	Chapter 7

Abstract

Extant studies have painted a bleak picture of IS/IT investments showing low success rates for IS/IT projects. Project evaluations are crucial for organizations to identify difficulties and forewarn organizations of any potential fiascos during project execution. However, evaluations may be hampered by problematic situations known as equivocal situations. Equivocal situations are conceived as the root of circumstantial escalation. In such situations, decision-makers are compelled to make erratic and biased decisions on the continuation of on-going IS/IT projects. Extant studies are fragmented on the focal concepts of equivocality and studies pertaining to the causes of equivocal situations are still limited within IS/IT project evaluation context. This study aims to investigate the role of equivocality in IS/IT project evaluations by means of identifying and discussing the typical characteristics of equivocal situations as well as the causes. Current literature is analyzed and synthesized to achieve these objectives. The contributions lie in the distillation of equivocality and the formation of eight potential causes posited to induce equivocal situations in IS/IT project evaluations. This study presents a framework that pulls together the characteristics of equivocal situations and the causes within evaluation frames. The study offers knowledge to practitioners concerning the indications of equivocal situations and the potential causes of such situations that they should be aware of when embarking on evaluations of their IS/IT projects.

2.1 Introduction

Information systems and information technology (IS/IT) investment expenditures have grown globally and on average represent 40-45% of firm investments (Cha et al. 2009). Gartner predicts IS/IT expenditure will grow by 2.4% worldwide in 2015⁶. The top five expenditure categories will be: security technology, cloud computing, business analytics, application developments/upgrades or replacements, and wireless/mobile technology, as forecast by the Computerworld⁷. Many organizations invest enormous amounts on IS/IT –as they are increasingly becoming dependent on it. Yet, numerous studies have painted a bleak picture of IS/IT investments and revealed low success rates for IS/IT projects (Emam and Koru 2008; Eveleens and Verhoef 2010; Keil and Mähring 2010). The investments might constitute high-risk endeavors such as large-scale and ‘black swan’ IS/IT projects that seem to take on a life of their own and are deemed, eventually, to fail (Buhl 2012; Buhl and Meier 2011; Lee et al. 2012). This problem remains an elusive challenge for organizations. Keil (1995) commented: “*one of the most difficult management issues that can arise in connection with IT projects is deciding whether to abandon or continue a project that is in trouble*” (p. 422).

Arguably, decision-making is concerned with evaluating and justifying the choice of action (Gunasekaran et al. 2006; Pan et al. 2006; Seddon et al. 2002). To control the risk associated with the projects, Pan et al. (2006) suggest the practice of evaluation. Employing effective evaluations is of utmost importance to detect difficulties and forewarn management of any potential fiascos during project execution so that higher project success rate can be achieved (Pan et al. 2006). The projects may proceed with several possible courses of action. This may include decisions ranging from continuing the projects as planned to abandoning the projects. Organizations may also revise the justified plans and business cases based on the evaluations. Thus, project evaluations are the focal point of continuation decisions and to proceed with well-positioned strategies (Hassler and Tribble 2010; Snow and Keil 2002a; Thompson et al. 2007).

⁶<http://www.gartner.com/newsroom/id/2959717>(accessed March 2015)

⁷<http://www.computerworld.com/article/2840907/forecast-2015-it-spending-on-an-upswing.html> (accessed March 2015)

In spite of the above value, organizations encounter difficulties employing evaluations in practice (Abdel-Hamid et al. 1993; Mähring and Keil 2008). Organizations are confronted with ambiguity, uncertainty, and conflict as evaluations and the subsequent decisions are likely to suffer from different interpretations of the underlying organizational problems (Brown 2005). Information associated with the projects may suffer from multiple interpretations and a lack of clarity; hence, it may arouse disagreement among decision-makers (Irani 2002; Smithson and Hirschheim 1998b).

Prior studies related to continuation decisions of IS/IT projects focus on the formation of psychological factors that often trap decision-makers to continue the unpromising ventures (cf. entrapment) implying flawed continuation decisions and errors in decision-making (Drummond 1998). Nevertheless, Bowen (1987) posits making continuation decisions as dilemmas which occurs when decision-makers are confronted with equivocal situations. Equivocal situations in evaluations might potentially lead to problematic decisions, such as unwarranted continuation and premature termination (Drummond 2005; Tiwana et al. 2006). Decision-makers need to be aware of the potential problems as well as the implication of decisions taken in such equivocal situations.

However, discussions on how equivocal situations emerge when evaluating the projects' next course of action are still limited. The concept of equivocality in IS/IT project evaluations is not yet well defined and the antecedents or causes of equivocality are not well understood. An improved understanding of equivocality is needed to define what is an equivocal situation and what is the role of equivocality in the context of IS/IT project evaluations. Understanding the concept of equivocality means to elaborate more on what are the characteristics of equivocal situations in project evaluations and what are the causes of such situations. Understanding the causes of equivocal situations could enhance decision-making by helping decision-makers to decide a course of action in a purposeful fashion.

Based on this gap, specifically, this paper endeavors to answer the following research questions: (1) how can equivocal situations in IS/IT project evaluations be defined and what are the characteristics of such situations? (2) what are the conceivable causes of equivocal situations in IS/IT project evaluations?

We aim to investigate the role of equivocality in IS/IT project evaluations by identifying typical characteristics and the causes of equivocal situations. This is imperative to lay the foundation of equivocality in IS/IT project evaluations for future research. Distillation of the characteristics and the potential causes of equivocal situations in project evaluations will open up possibilities for further studies, especially to corroborate the current premise. To achieve the objectives of our paper, a systematic literature review of continuation decisions (i.e., escalation and abandonment) with respect to equivocality is vital to conceptualize the equivocal situations and the causes within the context of project evaluations. Thus, we conduct a review related to these topics. Specifically, we analyze and distil the related literature as well as link the continuation decisions to project evaluations by drawing on the IS/IT evaluation literature.

This study comprises six parts. In the second part, we discuss prior research in related fields to ours. Next, we elaborate on the design and strategy of the literature review. In the fourth part, we discuss the analysis of the literature review. Specifically, insights from the review are synthesized to improve our understanding of equivocality as well as to develop a-priori specifications of the causes of equivocality. In the fifth part, we present our framework. Finally, we highlight the conclusion of our study and propose the potential avenues for further studies.

2.2 Related Research: IS/IT Evaluation and Decision Dilemma Theory

The term evaluation of information systems and technology has its roots in the IS/IT evaluation research stream. Evaluation may be employed typically before (ex-ante) and/or after (ex-post) project execution. Ex-post or summative evaluation refers to the review or assessment to demonstrate the outcome or the attainment of the developed IS/IT, which is commonly conducted at the end of a project (Powell 1992). Conversely, ex-ante evaluation refers to the initial appraisal of project prior to the project implementation for justifying the use of organizational resources to achieve particular objectives (Powell 1992). This appraisal, which is also known as formative evaluation, strives particularly to (1) form a clear articulation of how the IS/IT would benefit the organizations; (2) identify detailed costs and benefits; and, (3) form a framework of how the project can be revisited or progressed throughout (Doherty and Mcaulay 2002).

Besides of these reasons, ex-ante evaluation or appraisal may also improve the IS/IT being developed by gaining a wide-ranging feedback and insight for the project's stakeholders. Contrasting the term of appraisal with evaluation, Ballantine and Stray (1998) highlight that:

Evaluation, on the other hand, is more frequently used in the literature to imply a much wider consideration of investments at different times, for example, evaluation might be carried out as the project is being developed, implemented or indeed after implementation. However, we would like to stress that appraisal and evaluation are viewed as aspects of the same decision-making process, in addition to recognizing that both activities are intrinsically linked within that decision making process. (p. 4)

Their description also outlines appraisal and evaluation as part of the decision-making process. Smithson and Hirschheim (1998a) refer to information systems evaluation as "*the assessment or appraisal of the value, worth or usefulness of an information system*" (p. 160). Highlighting the potential of multiple points of evaluation, Farbey et al. (1999) as echoed by Al-Yaseen et al. (2006) state that information systems and information technology evaluation is "*a process, or group of parallel processes, which take place at different points in time or continuously, for searching and for making explicit, quantitatively or qualitatively, all the impacts of an IT project and the programme and strategy of which it is a part*" (p. 190). To attain an effective evaluation, the involvement of important stakeholders, the utilization of evaluation criteria and techniques are essential (Willcocks and Lester 1996).

Numerous studies on IS/IT evaluations have appeared both in academic journals and publication for practitioners. These studies mostly aim to identify particular difficulties in employing evaluations at different points and to develop frameworks or methods for helping practitioners evaluate their IS/IT investment (Barclay and Osei-Bryson 2010). Renkema & Berghout (1997) show a comparative review of investment evaluation methods for information systems at a proposal stage. They categorize their findings into four basic approaches of information systems investment evaluation, namely: (1) the financial approach; (2) the multi-criteria approach; (3) the ratio approach; and, (4) the portfolio approach. Their observation show that non-financial methods are hardly underpinned by theory and many methods are focusing on the

evaluation criteria instead of evaluation process. They suggest using the portfolio methods so that the non-financial criteria will be easier to apply and recommend combining the features of different approaches to overcome the potential differences among the methods. Within IS/IT evaluation research, deciding the project's next course of action is an issue of evaluating and justifying the investment expenditure, specifically through the use of appraisal methods and techniques. This is best illustrated by Irani et al. (2005): "*IS evaluation is a decision-making technique that allows an organization to benchmark and define costs, benefits, risks and implications of investing in IT/IS systems and infrastructures*" (p. 213).

Furthermore, the term entrapment and escalation of commitment (Brockner 1992; Whyte 1986) can be traced back to early studies related to continuation decisions of projects. These studies referred to entrapment and escalation as a phenomenon when decision-makers are entrapped in making a commitment of additional resources to a failing course of action. In recent studies, the continuation decisions for projects, on giving them additional resources and/or reducing their initial requirements, is often referred to as project escalation (Lee et al. 2012; Wei et al. 2003). These projects typically exceed their initial budget and schedule. On the other hand, termination of all project activities, before their full implementation, is known as project abandonment (Ewusi-Mensah and Przasnyski 1991). Prior studies have reported extensively on various IS/IT projects that suffer from repeated escalations and end up with abandonment (Ewusi-Mensah and Przasnyski 1991; Mähring and Keil 2008; Newman and Sabherwal 1996; Oz and Sosik 2000).

Bowen (1987) coined the term 'equivocal information' to information with multiple (positive or negative) interpretations. Based on the theory, equivocal information may lead to escalation (Bowen 1987). When decisions are required in equivocal conditions, escalations are likely to occur, caused by the belief that commitment of additional resources are economically prudent. The occurrence might also be caused by curiosity to learn or to understand the equivocal situations by means of the upcoming information. It is expected that completing the endeavor will eventually deliver benefits (Brockner 1992). Escalation occurs when decision-makers assume the information is inadequate and suggest that additional investments will not fulfill expectations. To abandon the endeavor, unequivocal negative information is required;

this in order to convince decision-makers the projects are no longer beneficial, implying that even additional resources would not bring success (Bowen 1987).

Bowen's (1987) view has gained support from other fields, such as Psychology, Management, as well as Information Systems. Recent studies have shown the importance of equivocality in affecting the decision to escalate or abandon. For instance in management literature, Sleesman et al. (2012) found the significance of the 'information set' construct, consisting of information acquisition and decision uncertainty, drawn from Bowen's view, as the determinant of escalation. Specifically, based on their meta-analysis, information acquisition was found to be one of the strongest inhibitors that will reduce the likelihood of escalation.

Meanwhile during project execution, organizations are urged to evaluate projects that have already been justified to ensure their continued support. Based on the new information surrounding the projects, evaluation during project execution aims to: (1) provide an indication of the projects' progress and likely success; (2) appraise the worthiness of continuing the projects, and; (3) allow the intervention of projects which deviate from their plan (Seddon et al. 2002; Snow and Keil 2002a; Thompson et al. 2007). Accordingly, a project review or evaluation is conducted. It is a process wherein resources are described for their merit and worth after a set of standards have been judged and compared as suitable for their context. This is followed by a decision as to whether to realize the project further (Remenyi et al. 2007).

Intriguingly, the prevalence of equivocal situations coincide with the evaluation of IS/IT projects. Equivocal situations frequently occur in IS/IT project evaluation as the existence of multiple interpretations of information surround the project which fosters disagreement among decision-makers and encourages negotiation regarding the next course of action (Irani 2002; Smithson and Hirschheim 1998b). Decision-makers might interpret the projects' worthiness from unclear indications and get trapped in dilemmatic situations due to lack of clarity and understanding of the situations. Thus, decisions often rely upon personal experiences and judgments and are frequently made in equivocal conditions (Bannister and Remenyi 2000).

2.3 Review Design and Strategy

2.3.1 Search strategy

A review of prior studies is conducted (1) to define an equivocal situation and its characteristics by examining the main concept of equivocality as well as its relation to the decision of escalation/abandonment; (2) to develop a-priori specifications of the causes of equivocality; and, (3) to build a theoretical framework that contributes to the understanding of equivocal situations and their causes within the evaluation frame (Webster and Watson 2002).

The keywords (escalat* OR abandon*) AND (information equivocal*) were used in two databases: (1) EBSCOhost which consists of Business Source Elite, EconLit, PsycARTICLES and Psychology and Behavioral Sciences Collection, and (2) SciVerse Scopus which includes subject areas in Social Science & Humanities. The terms information equivocality or equivocal information were used since they are more specific to the area of interest rather than the terms ambiguous or ambiguity. The terms ambiguous or ambiguity would yield many irrelevant publications, as the words ambiguous or ambiguity are used in a general way in their texts. Furthermore, earlier studies which inspired this research also used the term equivocal information.

The query expression, which was applied to the full text and limited to peer-reviewed journals, was opted for to obtain publications related to decision-making (i.e., escalation or abandonment) and equivocality. The two databases were considered sufficient as they cover most of the top IS/IT and Business/Management journals mentioned in R. Kelly Rainer and Miller (2005) and Barnes (2005). The query yielded 155 publications dated from 1980 to 2015. Three publications were excluded as they were duplicate and self-publication. Emails were sent to the authors to obtain the full-text version. In case of unavailability of the full-text version or non-English publications, the abstracts were used further. The titles and abstracts of the remaining set were perused.

In general, the publications need to describe, examine, or use the concept of equivocality and the causes of equivocality. The selected publications can be either conceptual or empirical studies. Specifically, we sought out: (1) insights from the publication to define equivocality and further form indicators to gauge an equivocal situation; (2) insights of issues which can be developed to form categories of causes or

antecedents of equivocal situations; (3) the emergence of equivocality in organization activities or practices, especially in projects such as IS/IT or similar innovation endeavors; (4) the relation between equivocality and decision-making; (5) empirical studies describing applications of the concept of equivocality or the causes of equivocality. These purposes served as criteria to select the appropriate publications for further examination. Additional articles were obtained by crosschecking the authors and references. Fifteen publications were considered as relevant publications and added to the pool. Finally, a total of 30 publications were used as the basis for this research. Figure 3 illustrates a flow chart of the aforementioned search strategy and the review process.

The emergence of the computer assisted qualitative data analysis software (CAQDAS) allows us to use ATLAS.ti to assist in the analysis and synthesis of the literature. ATLAS.ti is a text analysis tool initially designed to manage complexity in qualitative data. By combining ATLAS.ti with reference manager, this set of tools is capable of supporting the documentation of the process of analyzing and synthesizing the selected publications effectively (Bandara et al. 2011).

The selected 30 publications were fed into the ATLAS.ti hermeneutic unit. The publications served as source documents, whereby codes were assigned to the paragraphs or the sentences (Wolfswinkel et al. 2013). The codes assignment was derived from the research objectives and questions. Thus, the starting point was the concept and causes of equivocality. The description of equivocality and the parts where its causes were mentioned explicitly or implicitly were highlighted and extracted. The applications or operationalization of equivocality were noted from the context of the studies as well as the important insights. During the iterative process and analysis, several codes and categories were developed, extended and merged in order to make decent conceptually substantiated categories (Miles and Huberman 1994). Similar concepts or closely related ideas were arranged iteratively in tree-like structures of categories and codes using the ATLAS.ti's networks editor and MS Visio. An example of tree-like structures of categories and codes is depicted in Figure 4.

Figure 3. Search strategy for literature reviews

Figure 4. Network view of ATLAS.ti

Preliminary derivable tables of the concept and causes of equivocality were established through this process and used to view several codes together and to summarize the data analysis. Specifically, a-priori causes of equivocality were established; these categories were developed further by delineating their definitions. Notes of the analysis can be found in the memos feature of ATLAS.ti, providing the opportunity to reinterpret the data and for further development of the investigated area. The coding process is depicted in Table 2.

Table 2. Examples of the coding process

Excerpt	Category and code
<i>"Managers are not certain what questions to ask, and if questions are posed there is no store of objective data to provide an answer."</i>	Concept of Equivocality: Deficiency: Particular types of data/information

Excerpt	Category and code
<i>"..it is difficult to ask any questions, as the organization is not aware of the variables that may affect the decision making process."</i>	Concept of Equivocality: Deficiency: Influencing variables
<i>"..large differences between the departments is a source of high equivocality based on the fact that the departments would have very different interpretations of the same ambiguous situation.."</i>	Causes of Equivocality: Different frames of reference: Department difference
<i>"Many organizational decision makers are not given a clear idea of success and failure criteria at the time that decisions are made."</i>	Causes of Equivocality: Lack of standards: Unclear criteria

2.3.2 Description of the Publications

The thirty publications come from various domains and research areas. Based on SJR-SCImago Journal & Country Rank (<http://www.scimagojr.com>), the top two domains/research areas of the publications are Management Information Systems (MIS) and Strategy and Management (SM). 13% of the publications belong to Applied Psychology (Psi). A few publications come from Management Science and Operations Research (MO), Accounting (Acc) and Organizational Behavior (OB). Figure 5 depicts the distribution of publications resulted from the search strategy. In terms of methodological type, most of the publications use case studies and experiments (23%). 20% of the publications are using survey and another 20% are categorized as conceptual papers. In terms of the number of publications over the years, the trend is growing. Based on the selected publications, the studies on equivocality have been conducted with different foci. These publications are distributed across distinct domains. Equivocality is appeared to be a relevant problem faced by organizations as it has received much attention and has been viewed in different areas and angles over a few decades.

Figure 5. Distribution of the publications (N=30)

2.4 Analysis of the Literature Review

2.4.1 Concept and Characteristics of Equivocality

The term ‘equivocality’ can be traced back to its inception in 1979 by Weick in “*The Social Psychology of Organizing*” in the psychology domain. Weick (2001) describes “*an equivocal is something that admits of several possible or plausible interpretations and therefore can be esoteric, subject to misunderstandings, uncertain, complex, and recondite*” (p. 148). This is pointed especially to innovation and newly introduced systems/technologies as he explained “*new technologies mean many things because they are simultaneously the source of stochastic events, continuous events, and abstract events*” (p. 148). Weick argue that people (e.g., different groups of users) may ascribe different meanings to an identical technology. He coins ‘sensemaking’ to understand of how people ascribe meanings and how their interpretations may affect their behavior (Weick 2001).

The sense-making as a process to understand people’s interpretations toward a technology is vital to ascertain the prevailing interaction between them as a new system or technology is being developed or introduced (Weick 2001). Weick et al. (2005) state “*the idea that sensemaking is focused on equivocality gives primacy to the search for meaning as a way to deal with uncertainty*” (p. 414). It is the process of making sense of an ill-defined situation and of conceiving a way to deal with such problematic situation (Weick et al. 2005). Sense-making may provide assistance to understand the equivocality in evaluations; this, will be elaborated on in Section 2.6.

The equivocality term was then taken up by the management and organization domain and was reconciled with Galbraith’s concept of uncertainty (1977) by Daft & Lengel in 1984 (Brun and Sactre 2008). Around the same era, in his seminal works, Bowen (1987) incorporated equivocality further in the management/organization domain by challenging the conventional wisdom of the cause of escalation, which was previously dominated by psychological explanations (i.e., self-justification). Equivocal information as coined by Bowen is defined as “*feedback for which multiple (positive or negative) interpretations can be constructed*” (Bowen 1987) (p. 56).

Almost half of the selected publications enact Bowen’s view of escalation and relate the erratic decision of escalation to the problem of equivocality (i.e., 42% are related to decision-making). These studies, specifically in experimental psychology,

reinforce Bowen's view and aim to substantiate the relation between equivocality and escalation. Bragger et al. (1998) demonstrate that high equivocality and unavailability of opportunities to obtain additional information of the projects lead to postponed abandonment and escalation. In their experiment scenarios, high and low equivocality is operationalized by manipulating the variation in the investment feedbacks. These variations also lack a recognizable pattern. This finding is consistent with Dixit's theory, which states that an uncertain environment can affect decision-makers to continue investing (Dixit 1989), and an earlier study of Garland et al. (1990) which shows that a negative unequivocal information leads to decision of abandonment as the expected future benefits of continuing is no longer outweigh the perceived costs.

Hantula and DeNicolis Bragger (1999) test empirically the effects of low and high information equivocality on escalation. Equivocality is interpreted as a temporal dimension and comprised of uncertainty showed by variability of feedback. They demonstrate that escalation is occurred when the information equivocality is high and the existence of standard or goal weakened the tendency to escalate. Equivocality is influenced by a contextual interpretation as the information is seen as neither clearly positive nor clearly negative (Hantula and DeNicolis Bragger 1999). Bragger et al. (2003) demonstrate that equivocal information resulted from insufficient goal specificity leads to escalation and persistence. Possibility to obtain additional information and prior decision-making history may also affect the decision to escalate.

Rationally, decision-makers search for and obtain information when deciding the continuation of a particular endeavor. Schultze et al. (2012) find no indication of bias on the level of information search, i.e., no selective search for information to support an initial decision in an escalation situation. Furthermore, Schultze and Schulz-Hardt (2015) provide additional insights into the relation between equivocality and escalation by including the influence of information sources (i.e., expert advices). They show that decision-makers are susceptible to biased expert advices and they cannot ignore them even when they know the advices are misleading (Schultze and Schulz-Hardt 2015).

Likewise, the studies that enact Bowen's view aim to point out the deficiency of the methods used to assess project values (e.g., Tiwana et al. (2006)). These studies suggest adopting the 'real options' perspective to rationalize escalation decisions (Keil and Flatto 1999). Real options theory offers an alternative viewpoint of IS/IT investment

and suggests a more balance gauge to the traditional cost-benefit analysis of the projects (Tiwana et al. 2006). According this perspective, escalating projects are needed and considered to be rational in certain cases (Tiwana et al. 2006). Furthermore, a study by Pan et al. (2006) specifically examines the dynamics of escalation and de-escalation through an evaluation framework. Additionally, two studies adopt Staw's four determinants of escalation (i.e., project, psychological, social and organizational) to examine the process of escalation (Mähring and Keil 2008; Newman and Sabherwal 1996) and one study incorporates Bowen's critics who defend Staw's Self-Justification theory. These studies give additional insights into how equivocal situations might emerge in IS/IT projects. The aforementioned studies come from the Management Information Systems, Accounting, Management Science and Operations Research, and Strategy and Management domain.

The remaining publications are indirectly related to decision-making. Studies from the Management Information Systems domain discuss equivocality in the theme of (1) media richness (Daft et al. 1987; Lim and Benbasat 2000) and (2) the use of decision support systems (Zack 2007). These papers address the suitability of using 'richer' media or decision support systems to address the problem of the emergence of equivocality in communication. Next, equivocality is discussed in light of (3) MIS development methodologies (requirement determination, success and failure, and management tools) (Fazlollahi and Tanniru 1991; Jones and Kydd 1988; Kydd 1989); (4) users/clients satisfaction of IS/IT development (Watts Sussman and Guinan 1999); and, (5) engineering project task and industrialized construction (Chang and Tien 2006; Levander et al. 2011). Moreover, studies from the Strategy and Management domain discuss equivocality in the theme of (1) new product development (NPD) (integration and performance, contracting effectiveness, fuzzy front end process) (Brun and Saetre 2008; Carson et al. 2006; Koufteros et al. 2005), for instance, the role of equivocality in influencing the new product development process; and, (2) organizational design (Griesinger 1990).

To attain general agreement from the selected publications on the definition of equivocality is not a straightforward task. The term of equivocality is often described and mixed with other more commonly used terms. For instance, using uncertainty to describe equivocality: "*...in escalation situations, equivocality encompasses both the variability*

of feedback data described by uncertainty and the more contextual factors which may influence interpretation" (Hantula and DeNicolis Bragger 1999) (p. 426). Using ambiguity to describe equivocality "*equivocality means ambiguity, the existence of multiple and conflicting interpretations about an organizational situation.*" (Daft et al. 1987) (p. 357). We discern that most publications view equivocality to be analogous with ambiguity and use them synonymously and interchangeably.

One of the selected publications, Zack (2007), attempts to distinguish four related problems of 'knowing', these are equivocality, ambiguity, uncertainty, and complexity. Zack (2007) makes a sharp distinction between the two –ambiguity and equivocality. He argues that ambiguity is caused by lack of knowledge, which should be resolved by acquiring knowledge or by an interpretive frame. Conversely, equivocality is caused by variety or diversity of knowledge, which should be resolved by restricting knowledge or diverse viewpoints.

However, the equivocal situation described by Bowen is closely related to Zack's view of ambiguity. Bowen state that equivocality could occur in a condition whereby decision-makers are unable to establish credible criteria to compare data. He argues that this condition is "*likely to occur in cognitively unstructured situations, where individuals have either insufficient or no knowledge of 'what leads to what'*" (p. 56). This statement implies Zack's view of ambiguity where lack of knowledge exists in a situation. Additionally, these terms are closely related since they both engage similar activities in the same sphere, i.e., managing and processing knowledge (Malhotra 2001). The consolidated meaning of ambiguity and equivocality is then maintained.

We discern that a clearer distinction has been established toward uncertainty in most of the publications. Uncertainty refers to the lack or absence of information to both define current and predict upcoming situations that are typically reduced by acquiring additional data or information; uncertainty resides in the sphere of managing and processing information (Malhotra 2001; Zack 2007). Zack (2007) distinguishes uncertainty as "*not having enough information*". On the other hand, Frishammar et al. (2011) argue that uncertainty and equivocality are, to some extent, correlated and are similar in a sense of information is the vital key to reduce both problems; however, the information-processing activities are different. Uncertainty demands additional new information while equivocality necessitates the exchange of subjective information (e.g.,

views and judgements) among decision-makers (Frishammar et al. 2011). Swink and Schoenherr (2015) explain that decision-makers may obtain information to reduce uncertainty; however, the next course of action will not be a clear-cut decision as the meaning of the acquired information may be unclear and has different interpretations (i.e., equivocality). They suggest the act of sense-making to process the information and to develop a shared understanding (Swink and Schoenherr 2015).

In his paper, Zack (2007) also pointed out the term complexity as has *“more information than one can easily process.”* He states *“complex situations are not vague or unpredictable, but rather are clearly defined and potentially predictable situations whose length or intricacy of path, procedure, or variety of elements and relationships is too large to cognitively process easily.”* He argues that the perceived complexity of objects can be different among organizations or people, which depends on their experience, expertise, or knowledge. The state of knowledge possessed by organizations or people hence has impact on how organizations handle and perceive complexity. The notion of knowledge underscores: as *“a large number of parts that interact in a non-simple way”* is introduced to an event the absence (insufficient) or the existence of multiple knowledge may increase the perceived complexity and induce equivocality (Zack 2007). Koufteros et al. (2005) remark that the presence of complexity in products and processes may induce confusion and ambiguity in product development. Later in this study, we postulate the potential influence of complexity to the degree of equivocal situations occurring in project evaluations, termed as Complexity in the process. This will be elaborated on in the discussion about the causes of equivocality.

We attempted to untangle equivocality into distinct characteristics (Table 3) using the qualitative process mentioned in Section 2.3. Distillation of equivocality can be used to summarize and understand the important ideas and different facets of equivocality, and to form the notion of equivocal situations in the context of project evaluations. This is also invaluable to underline a proper situation considered as equivocal in the following exploration, for instance corroboration by field qualitative studies. To achieve this aim, we analyzed the extracted text, examined their similarities and repeated emergence, and then classified them in themes at different levels (Attride-Stirling 2001). A pool of this extracted text was interpreted; a reinterpretation was

sometimes needed to form a reasonable and distinguishable number of categories, and to translate them into the context of project evaluations (Attride-Stirling 2001).

We formed four categories, the first one was based on how the authors describe what equivocality is. Then, this category is related to the meaning of equivocality, named as ‘denotation of equivocality’. Equivocality has been associated mostly with the state of interpretation. Equivocality has been denoted with the presence of more than one interpretation, stimulated by particular information. Individually, the interpretations would not lead to equivocality; however, collectively they might induce equivocality (Zack 2007). Besides their multiplicity, the interpretations might also be in conflict and might indicate a sense of divergence. This state of interpretation is alleged to be induced by particular factors, such as different frames of reference or variability of “*feedback data*” (Hantula and DeNicolis Bragger 1999). Moreover, interpretations are sometimes connoted with “*conveyed meanings*” and “*perceptions*”. When equivocal situations have occurred, equivocality is alleged to be more related to the current and the past event than the future endeavor (Carson et al. 2006).

The second category highlighted deficiencies in equivocal situations as described by the authors. We named this category as ‘deficiency in an equivocal situation’. Equivocal situations have been associated with deficiencies related to decision-making support. The deficiencies have been described in many ways or as different types, such as the absence of more tangible or objective sources of information or information that lacks pattern or predictability. Additionally, several outcomes due to deficiency have also been mentioned, such as relying upon experience, intuition or judgment to support the decision-making (Kydd 1989).

The third category underlined the information and the data in equivocal situations as mentioned by the authors. We named this category as ‘information and data in an equivocal situation’. Equivocal situations have been associated with the demand and provision of particular data or information, such as the demand for richer information or the desirability for more and different types of information. It is alleged that information-processing activities are different when dealing with equivocal situations and that decision-makers need to examine the problems or situations beyond their usual contexts (Frishammar et al. 2011).

Finally, the authors of the selected publications described several instances of events when decision-makers are confronted with equivocal situations. We named this category as ‘action toward equivocality’. Several actions toward equivocality have been referred to. In equivocal situations, decision-makers should try to reduce or resolve the problematic conditions by attaining convergence of diverse interpretations and overcoming disagreement. Several actions were noted, such as developing similar judgments, the social exchange of opinions and beliefs, or the exchange of subjective/existing views (Griesinger 1990).

Accordingly, equivocal situations are described as states where lack of knowledge or diverse knowledge exist at the time of evaluating the IS/IT projects. The states are indicated by: (1) the existence of multiple interpretations, conveyed meanings or perceptions toward the projects, which leads to lack of clarity and confusion about the next course of action; (2) the indeterminacy of analyzed data to support decision-making; (3) the demand for ‘richer’ or different types of information; and, (4) the involvement of decision-makers in reaping consensus by exchanging views and judgments through social interaction to settle disagreements.

Table 3. Untangling equivocality

Characteristics	Examples of Excerpts	References
Denotation of equivocality	<p><i>“Equivocality implies the existence of multiple and conflicting interpretations about an organizational situation”</i></p> <p><i>“..equivocality presumes a messy, unclear field and an information stimulus that may have several interpretations”</i></p>	<p>Fazlollahi and Tanniru (1991)</p> <p>Daft et al. (1987)</p> <p>Koufteros et al. (2005)</p> <p>Zack (2007)</p> <p>Hantula and DeNicolis</p> <p>Bragger (1999)</p> <p>Carson et al. (2006)</p> <p>Williams et al. (2013)</p> <p>Ashforth et al. (2014)</p>
Deficiency in an equivocal situation	<p><i>“Equivocality can be defined as the lack of pattern or predictability of feedback”</i></p>	<p>Bragger et al. (1998)</p> <p>Griesinger (1990)</p> <p>Daft et al. (1987)</p>

	<i>"..social processes are sought when more tangible, objective sources of information are unavailable"</i>	Jones and Kydd (1988) Fazlollahi and Tanniru (1991) Brun and Sactre (2008) Kydd (1989)
Information and data in an equivocal situation	<i>"..is possible not only by providing more information, but also by providing different kinds of information.."</i> <i>" Managers may have to spend time thinking about what to do, search beyond current databases"</i>	Brun and Sactre (2008) Daft et al. (1987) Frishammar et al. (2011) Fazlollahi and Tanniru (1991) Xuefei and Tawei (2014) Schultze et al. (2012) Schultze and Schulz-Hardt (2015)
Action toward equivocality	<i>"..equivocality leads to the social exchange of opinions and beliefs.."</i> <i>"..equivocality is reduced by using consensus seeking procedures"</i>	Frishammar et al. (2011) Griesinger (1990) Daft et al. (1987) Kydd (1989) Fazlollahi and Tanniru (1991) Xuefei and Tawei (2014) Swink and Schoenherr (2015)

2.5 Causes of Equivocality

Twenty publications provide insights into the causes of equivocality. Several studies provide explicit indications of the causes; however, some studies merely imply the existence of the factors that might influence equivocal situations. Due to the limitation of empirical evidence concerning the cause of equivocality in IS/IT projects, closely related or analogous contexts were analyzed and factors that were explicitly or implicitly mentioned were extracted for further investigation. A set category of potential

causes of equivocality is formed from the analysis. The emerging categories are the result of an iterative process of coding and categorizing the descriptions, the explanations, and the arguments of the selected publications on equivocality, as described in the Section 2.3. Eight potential causes of equivocality are identified through this approach. Based on these qualitative steps, we formulate and present research propositions to illustrate the expected effects of each antecedent or cause on the prevailing equivocal situations in project evaluations. They are delineated below:

1. *Complexity in the process* is defined as the extent to which the process of developing the intended IS/IT involves substantial intricacy.

IS/IT projects typically demand more conceptual work and knowledge-intensive processes, involving wide-ranging expertise. The craft aspects of the development process in such projects have an impact on the complexity, on promoting equivocality (Jones and Kydd 1988). Even so, the project is typically made up of many intricate and interdependence parts and elements of the intended systems as well as the required technologies (Chang and Tien 2006). Moreover, the crafting process is conceived to be a less-analyzable task in that it can fuel the equivocality surrounding the development process and the evaluation as well (Lim and Benbasat 2000). The presence of substantial complexity during the development process is perceived as the potential root of equivocality; this becomes the problem when transferred into the evaluation equation (Koufteros et al. 2005). Complexity in the process can be indicated, for instance, by the interdependencies among project tasks that require higher levels of coordination. Developing systems that operate or are connected to a large number of different systems, both intra- or inter-organizationally, might face this kind of complexity as well. We hence propose that:

Proposition 1. Considerable complexity involved in the process of developing the IS/IT, in the context of IS/IT project evaluation, is associated with equivocal situations.

2. *Sophistication of technology* is defined as the extent to which the design of IS/IT products or solutions is considered innovative or advanced.

IS/IT investments are typically oriented toward one of the categories, namely 'automate', 'informate', or 'transformate' (Banker et al. 2011; Zuboff 1985). These types of orientation have diverse degrees of novelty and involvement of new

technologies. Radical innovations, which are typically found in the category of 'transformate' as opposed to 'automate', such as incremental improvement projects, show differences in how the evaluations are handled (Farbey et al. 1995). Evaluating transformation projects are associated with more experimental and judgmental processes and thus are perceived as a challenging process for organizations (Farbey et al. 1995). Equivocal situations might potentially emerge when the initiators, users and the developers deal with new and sophisticated technology or with unfamiliar innovative projects for IS/IT investments (Kydd 1989). The unfamiliarity often leads to difficulty in defining the intended IS/IT as well as the prerequisites for embracing such technology (Brun and Saetre 2008; Fazlollahi and Tanniru 1991). Novel concepts related to particular information systems and the involvement of new technologies within the projects might therefore be of fundamental importance in causing equivocal situations. We hence propose that:

Proposition 2. Extensive innovation or advanced technology involved in the design of IS/IT, in the context of IS/IT project evaluation, is associated with equivocal situations.

3. *Challenges in project management* refers to the extent to which the IS/IT project encounters substantial management challenges.

Project management, specifically in IS/IT investments, is highly essential to minimize the risks and thus vital to the performance of IS/IT projects (Gemino et al. 2007). Practices of project management are typically comprised of holistic and complete guidelines on how to thoroughly deal with the process of IS/IT development. These practices form the basis for organizations to determine project performance and which strategy is well-positioned to accomplish their IS/IT investment objectives. However, several of these practices might contribute substantially to the induction of equivocal situations if they are not handled correctly (Hartman and Ashrafi 2002). For instance, equivocal situations might emerge when there are volatile requirements associated with ever changing expectations of numerous stakeholders (Jones and Kydd 1988; Kydd 1989). It is also reported that the manner in which projects are planned and defined in the project charter, for instance lacking clear objectives, measurable goals, important assumptions and

constraints to guide the project, often leads to equivocality when assessing such projects (Mähring and Keil 2008). We hence propose that:

Proposition 3. Substantial management challenges during project execution, in the context of IS/IT project evaluation, is associated with equivocal situations.

4. *Lack of standards* is defined as the extent to which evaluators/decision-makers utilize evaluation criteria to ascertain the project value.

Standards or criteria are a crucial consideration in evaluation since they form the basis for determining whether the projects are still beneficial or not. Evaluation offers less value as there is no choice of credible criteria to appraise the projects. However, in cognitively unstructured situations decision-makers might feel the necessity to include certain criteria; however, they might also lack the understanding and confidence to estimate and, afterwards, to make decisions based on them (Serafeimidis and Smithson 2003). There are possible difficulties as well in establishing credible standards or criteria to ascertain the worthiness of continuing the projects. This might occur since decision-makers could have different views toward the degree of importance of particular standards, which could impede reaching a consensus (Bowen 1987). Organizations' vague criteria of success and failure might induce these situations as well (Hantula and DeNicolis Bragger 1999). Presumably, inclusion of different criteria can affect the evaluation outcome considerably. We hence propose that:

Proposition 4. The utilization of evaluation criteria, in the context of IS/IT project evaluation, is associated with equivocal situations.

5. *Changes in external state* refers to the extent to which the project is affected by organizational environmental dynamics.

The constantly changing environment might induce equivocality as decision-makers are confronted with difficulty in determining and predicting the impact of IS/IT projects during evaluation (Fazlollahi and Tanniru 1991). Strong environmental dynamics might impose major alterations to the project. External changes such as technological/business trends or business requirements, corporate politics, and changes in organizational management are challenging to envisage. Particular types of IS/IT projects are affected or driven significantly by these changes. Some IS/IT projects are also contingent on the favorability of business conditions. For instance,

disagreement and conflict during evaluation might be entitled to equivocal situations that permit external dynamics such as “*political maneuvering*” (Mähring and Keil 2008). We hence propose that:

Proposition 5. The prevailing organizational environmental dynamics during project execution, in the context of IS/IT project evaluation, is associated with equivocal situations.

6. *Different frames of reference* refers to the extent to which evaluators/decision-makers have diverse viewpoints when evaluating the project.

Decision-makers or evaluators are typically composed of people working together in a group. These people might come from different functional areas or even different managerial levels but are also involved as stakeholders in the IS/IT investments. Different people may have different perspectives of the value of IS/IT investments. Decision-makers might be trapped in equivocal situations when divergent perspectives exist among people from different functional departments as opposed to a more homogenous group (Pelled et al. 1999; Simons et al. 1999). Responses to organizational issues may depend on the functional areas or individuals who interpret the obtained information (Williams et al. 2013). Misunderstanding and different opinions may lead to the emergence of disagreement in equivocal situations due to divergent perspectives (Levander et al. 2011). Nonexistence of a common perspective will force decision-makers to interpret the problem from unclear indications according to their background and to negotiate the next course of action (Daft et al. 1987). Varying interests and functional backgrounds among different departments as well as interdepartmental relations are suspected to be the backdrop of this situation. This factor is also induced by issues related to the project team members, such as involvement of new members at later stages and personal conflicts (Frishammar et al. 2011). We hence propose that:

Proposition 6. The prevailing diverse viewpoints of evaluators/decision-makers, in the context of IS/IT project evaluation, is associated with equivocal situations.

7. *Failure of evaluation method* refers to the extent to which evaluators/decision-makers apply techniques or tools to evaluate the projects.

Bowen (1987) states implicitly that equivocal situations might emerge when the decision-makers fail to compare data to a set of criteria. This condition is translated as disability to perform the comparing process through particular methods. Without realistic evaluation methods to compare and analyze the established criteria, the outcome of the evaluation will add little value when deciding on project continuation. The conditions, when the utilized evaluation methods lack the capability to make apparent comparisons, might also create confusion or ambiguity of projects' worthiness. Examination of used evaluation methods becomes important since these conditions might lead to high equivocality. In IS/IT evaluation literature, the comparison typically involves particular techniques and tools to assist decision-making. In line with this concept, the limitations of such methods have been indicated as the potential causes of equivocal situations (Keil and Flatto 1999). We hence propose that:

Proposition 7. The application of technique or tools by evaluators/decision-makers, in the context of IS/IT project evaluation, is associated with equivocal situations.

8. *Lack of evaluation data* refers to the extent to which evaluators/decision-makers use data surrounding the project to support decision-making.

The unavailability of sufficient data in terms of types, quantity and quality might hinder decision-makers from asserting the projects progress and their future attainment. Ambiguity of data related to a project is included as part of the project determinant of escalation (Newman and Sabherwal 1996). Specifically, information on the projects past performance could contribute to equivocality. Moreover, Brun and Saetre (2008) indicated that validity and reliability of information surrounding the projects might induce equivocality as well. Although information overload might also exacerbate the equivocal situations, previous studies have highlighted the lack of data/information (Bowen 1987; Levander et al. 2011). The novelty of the projects might cause difficulties in composing the data and then benchmarking the performance (Levander et al. 2011). Indeterminable, lack of clarity, and little data/information are alleged to cause equivocal situations as evaluators/decision-makers will interpret the situations from vague cues and use that to negotiate the next course of action (Frishammar et al. 2011; Hantula and DeNicolis Bragger 1999; Levander et al. 2011). We hence propose that:

Proposition 8. The use of data surrounding the project by evaluators/decision-makers, in the context of IS/IT project evaluation, is associated with equivocal situations.

Table 4 summarizes the publications used in this study and their domain. This table shows the publications which are related to the causes of equivocality. Other publications, which contribute to the review but are indirectly related to the causes of equivocality, are: Griesinger (1990) from Strategy and Management (SM), Bragger et al. (1998) and Ashforth et al. (2014) from Organizational Behavior (OB), Watts Sussman and Guinan (1999) from Management Information Systems (MIS), Schulz and Cheng (2002) and Xuefei and Tawei (2014) from Accounting (Acc), and Bragger et al. (2003), Schultze et al. (2012), and Schultze and Schulz-Hardt (2015) from Psychology (Psi), Swink and Schoenherr (2015) from Management Science and Operations Research (MO). In the table, the causes of equivocality are mapped into three higher categories: Content, Context, and Process. These higher categories will be elaborated on in the next section.

Table 4. Selected publications and the potential causes of equivocality (sorted by year)

No.	Article	Domain	Cause related to							
			Content				Context		Process	
			Complexity in process	Sophistication of technology	Challenges in project management	Lack of standards	Changes in external state	Different frames of reference	Failure of evaluation methods	Lack of evaluation data
1	Bowen (1987)	SM				x			x	x
2	Daft et al. (1987)	MIS						x		
3	Jones and Kydd (1988)	MIS	x		x			x		
4	Kydd (1989)	MIS		x	x					
5	Fazlollahi and Tanniru (1991)	MIS	x	x			x	x		
6	Newman and Sabherwal (1996)	MIS								x
7	Hantula and DeNicolis Bragger (1999)	Psi			x	x				
8	Keil and Flatto (1999)	MIS							x	
9	Lim and Benbasat (2000)	MIS	x							
10	Koufteros et al. (2005)	SM	x							
11	Zack (2007)	MIS						x		
12	Carson et al. (2006)	SM					x			
13	Chang and Tien (2006)	MIS	x				x			
14	Tiwana et al. (2006)	SM							x	
15	Pan et al. (2006)	MO			x					
16	Brun and Saetre (2008)	SM	x	x			x			
17	Mähring and Keil (2008)	SM			x					
18	Frishammar et al. (2011)	SM						x		
19	Levander et al. (2011)	MIS			x			x		
20	Williams et al. (2013)	SM						x		

2.6 Discussion: Insight from IS/IT Project Evaluation

Remenyi et al. (2007) recommend guidelines to attain an ideal evaluation; these are: (1) it should be comprehensive, involving opinions of all the major stakeholders; (2) it should focus on a full range of benefits or outcomes, both tangible and intangible; and, (3) it is extremely effective when performed regularly and continuously. Employing an evaluation is expected to encourage full discussion of co-evolving requirements and ensure that the object or process being evaluated continues to be relevant (Remenyi et al. 2007). Likewise, Frisk et al. (2015) state evaluation may require a multi-criteria and multi-stakeholder evaluation and decision process; an evaluation involves ‘hard’ and ‘soft’ methods: ‘hard’ numbers versus ‘subjective’ assessments, and stakeholders from diverse backgrounds. However, equivocal situation issues may arise from these requisites as explained by our propositions.

Prior research in IS/IT evaluation literature suggests viewing evaluation in the perspective of organizational change. When explaining major transformations in firms Pettigrew (1987) suggests “*The starting point for this analysis of strategic change is the notion that formulating the content of any new strategy inevitably entails managing its context and process.*” Symons (1991) underscores Pettigrew’s idea to scrutinize the interplay between the content and context of change as well as the process of managing change, and applies this idea to IS/IT evaluation. These three ‘dimensions’ are delineated as follows: (1) ‘Content’ relates to the features of evaluation metrics or the criteria used; the elements within the ‘what’ of evaluation; (2) ‘Context’ relates to the organizational multilevel systems and structures, such as the social, political, economic environment, cultural characteristics, or any related methodologies and processes; and, (3) ‘Process’ relates to the course of evaluation or the way evaluation should be done; the elements within the ‘how’ of evaluation (Frisk et al. 2015; Serafeimidis and Smithson 1999; Symons 1991). Serafeimidis and Smithson (1999) further highlight the necessity to understand the stakeholders’ roles and actions to improve the evaluation impact and contribution. Since the identified causes of equivocality are comprised of wide-ranging aspects, we consider the ‘Content’, ‘Context’, and ‘Process’ as a suitable framework to capture such mixture.

Several studies on evaluation in practice have translated Pettigrew’s perspective into a framework called Content, Context, and Process (CCP) of evaluation to examine constituents of evaluation as well as their interactions (Serafeimidis and Smithson 2000;

Stockdale and Standing 2006). By reflecting on the CCP framework, Stockdale and Standing (2006) stated that “*evaluation is guided by addressing the questions: why is the evaluation being done? What is being evaluated? Who affects the evaluation? When is the evaluation taking place? And how is the evaluation to be carried out?*” (p. 1090). Additionally, Goldkuhl and Lagsten (2012), through their conceptual practice model of evaluation (CPME), describe “*evaluation is conceived as a purposeful study of some evaluation object (evaluant) comprising 1) the generation of data of and from this object, 2) the selection and formulation of appropriate criteria to be used as yardsticks and 3) the matching of data and criteria in order to formulate evaluative statements and conclusions about the evaluation object*” (p. 6).

Stockdale and Standing’s extension of CCP and Goldkuhl and Lagsten’s CPME frameworks give a broad view on how evaluations are typically employed by organizations as a base for their decision-making. These frameworks suggest evaluation is a practice and a process to acquire additional knowledge related to an object that consists of several interconnected elements, for instance the evaluation criteria and evaluation procedure, within the context, content and process (Goldkuhl and Lagsten 2012). The broad view of these frameworks provides useful insights into the constituents of evaluation and the guidelines to establish key issues during evaluation (Stockdale and Standing 2006). We draw on these two and derive a new framework that pulls together the characteristics of equivocal situations, evaluation frames and their corresponding causes of equivocality, as depicted in Figure 6.

The content of evaluation refers to the constituents within the ‘what’ of evaluation. This consists of the object of evaluation (i.e., the IS/IT projects) and the establishment or generation of evaluation criteria. We identify four causes related to equivocality within the content of evaluation. The first, the second and the third causes are connected to IS/IT projects as objects of evaluation. Firstly, substantial intricacy in IS/IT developments could make the status or progress of the projects hard to estimate accurately. Secondly, sophistication of the technologies or the systems being implemented could hinder evaluators in ascertaining the projects, for instance due to lack of experiences or benchmarks. Thirdly, poorly managed projects could cause considerable difficulties in the evaluation, for instance lack of proper reports or monitoring from management. Finally, the fourth cause is related to the use of particular

evaluation criteria and evaluation could be problematic if there are neither clear criteria nor agreement on such criteria.

Figure 6. Framework of causes of equivocality in IS/IT project decisions and evaluations (based on Stockdale and Standing (2006) and Goldkuhl and Lagsten (2012))

The context of evaluation refers to the constituents within the contextual setting of the organizations. This consists of the external environment and the involvement of evaluators/decision-makers. We identify two causes related to equivocality within the context of evaluation. Firstly, substantial changes or environmental dynamics surrounding the project could confound the evaluations and the following decisions. Secondly, different perspectives of the people as evaluators could further complicate the evaluations.

The process of evaluation refers to the constituents within the 'how' of evaluation. This consists of the utilization of techniques and tools and the process of making sense of the data. Two causes are identified within this frame. These are the failure of evaluation methods and the lack of evaluation data/information. For instance,

the absence of evaluation procedures or adequate data to support decision-making could increase the likelihood of equivocal situations.

Furthermore, through the aforementioned view, we can recognize how the characteristics of equivocal situations might emerge within the content, context and process of an evaluation instigated by the identified causes. The content of the evaluation, the context in which the evaluation is employed and the process of how the evaluation is conducted might be interrelated and sometimes intertwined (Serafeimidis and Smithson 1999). For instance, diverse knowledge in equivocal situations can be recognized from the involvement of evaluators/decision-makers in the evaluation (Context). Different evaluators might have multiple interpretations or perceptions toward the object of evaluation or which evaluation criteria they will use (Content). How the evaluation should be conducted (Process) might also be effected by differences in their knowledge or frames of reference (e.g., different professional backgrounds, different departments).

When equivocal situations are perceived as lacking in data to support the decision in terms of tangibility or objectivity (Process), there may be difficulties in dealing with the external environment dynamics (Context) or in asserting the object of evaluation (Content). Moreover, lack of knowledge in equivocal situations can be recognized from the evaluation of novel information systems or information technologies such as black swan IS/IT projects (Content). In such cases, the causes might occur both in the Context (e.g., lack of experience or benchmarks used to foresee the projects) and in the Process as well (e.g., lack of appropriate evaluation methods to pinpoint past performance and the progress of the projects). Based on this elaboration, we hence propose that:

Proposition 9. An equivocal situation in an IS/IT project evaluation is influenced by the Content, Context, and Process of evaluation.

It appears that the emergence of an equivocal situation during a project evaluation is highly possible due to the unique nature exhibited in IS/IT projects. To name a few: the volatility of requirements, the intangibility of work processes and output, and the intangibility of benefits (Ewusi-Mensah 1997; Keil and Flatto 1999; Mähring and Keil 2008). IS/IT projects are often associated with numerous stakeholders who change the requirements and scope of the projects frequently (Nidumolu 1996; Zmud

1980). This volatility makes the projects hard to manage and control, especially in large scale information systems development. Information systems development projects are usually innovative, complex and group-oriented. Less certain project tasks among numerous individuals combined with lack of visible milestones make evaluating the project performance difficult and may lead to ambiguity concerning the project status (Sauer et al. 1999).

When comparing the intangible nature of IS development projects with other non-IS projects where the physical form and progress can be easily seen and measured, it is quite difficult to obtain precise estimates of how much work has been completed (Keil 1995; Sauer et al. 1999). Lastly, defining benefits related to the projects is a thorny issue. In some cases, it is hard to define these benefits explicitly, which then raises skepticism to pursue the projects (Ballantine et al. 1996; Irani and Love 2000). During evaluation, these challenges expose IS/IT projects to equivocal situations and make them vulnerable to receive negative feedback, which in turn will affect the continuation decision, i.e., whether to escalate or abandon.

Serafeimidis and Smithson (2003) offer the use of Weick's sense-making approach to deal with an evaluation which involves equivocality. They propose four possible IS/IT evaluation orientations based on the strategic decision-making classification; a two by two matrix combining IS/IT impact on organizations (tactical-strategic) and IS/IT objective/evaluation clarity or predictability and attainability (consensus/clarity-no consensus/ambiguity) (Serafeimidis and Smithson 2003). Serafeimidis and Smithson (2003) propose sense-making as a way to reach consensus and as a dialectic process between formal and informal behavior of decision-makers when the objectives of the IS/IT projects are ambiguous, not foreseeable, or disputable. Sense-making may lessen equivocality in project evaluations by revealing and disseminating multiple views and interests, developing common 'language', and by giving decision-makers the opportunities for negotiation and compromise after interpreting the formal evaluation information (Serafeimidis and Smithson 2003).

When the projects are considered as strategic in nature, sense-making evaluation may not suffice to handle the inherited uncertainty and ambiguity; thus, exploratory evaluation is suggested to instigate a paradigm change of the existing knowledge or to develop a new paradigm and generate knowledge, by eliciting decision-

makers' experience and intentions and/or by incorporating experts' judgement (Serafeimidis and Smithson 2003). For instance, equivocality rooted in vague project charters of highly innovative IS/IT may need iterative clarification and enhancement to establish mutual understanding and reach consensus. Exploratory evaluation then serves as alternative to 'act of faith' decisions and aims to re-justify claims in the business cases, generate knowledge, achieve shared understanding, and to prepare organizations with a well-positioned next course of action (Serafeimidis and Smithson 2003).

2.7 Conclusion and Further Research

The objective of this paper was to investigate the role of equivocality in IS/IT project evaluations by identifying typical characteristics and the causes of equivocal situations. An evaluation is opted to formulate additional knowledge concerning the project status and to ascertain the worthiness of continuing the project (Goldkuhl and Lagsten 2012); however, this purpose does not seem to be very successful as equivocality takes a role in an evaluation and hinders an informative and purposeful decision. A systematic literature review of continuation decisions (i.e., escalation and abandonment) with respect to equivocality is done to conceptualize the equivocal situations and the causes within the context of project evaluations. The four characteristics of equivocality provide descriptions that should closely represent equivocal situations, which might lead to erratic decision-making.

As a result, an equivocal situation in IS/IT project evaluation is defined as the state when decision-makers or evaluators encounter a lack of clarity and confusion when deciding on the continuation of a project. An equivocal situation occurs when lack of knowledge or diverse knowledge exists with regard to information associated with the project, especially its past performance and future attainment. This situation is typically shown by the existence of multiple interpretations, conveyed meanings or perceptions about the project.

This study identifies eight categories of causes that can serve as antecedents for equivocal situations. These are: (1) Complexity of the process; (2) Sophistication of the technology; (3) Challenges encountered in project management; (4) Lack of evaluation standards; (5) Changes in the external state; (6) Different frames of reference among decision-makers or evaluators; (7) The failure of evaluation methods; (8) Lack of

evaluation data to support decision-making. Formation of the eight categories is further enriched by establishing a framework that pulls together the characteristics of equivocal situations and the causes within evaluation frames.

The framework serves as a basis for further corroboration studies; for instance, the equivocal situation characteristics can be used to underscore proper situations (closely resemble our notion of equivocal situations) during project evaluations, so that insightful discussion and analyses can be derived. Arrangement of the equivocal situation causes within the framework can be used to examine which evaluation constituent has a major contribution to the prevailing equivocal situations during project evaluations. The framework proffer a conceivable connection with the extant studies of IS/IT evaluation and an explanation regarding the emergence of equivocality in project evaluations; enriches our current understanding of equivocality, evaluation, and continuation decisions. It is important to note that the framework and the causes of equivocal situations are not meant to address every problem or dilemma resulting from decisions on the continuation of IS/IT projects. The intention of this study is to establish a good grounding and awareness of the potential causes of equivocal situations that can lead to problematic decision-making.

Thus, our contribution lies in the distillation of equivocality and the formation of eight potential causes posited to induce equivocal situations in IS/IT project evaluations. Specifically, this study offers insights into the interplay of equivocality and evaluations and propositions of how equivocal situations emerge during project evaluations though the Content, Context, and Process framework. From a practical perspective, this study provides knowledge for practitioners regarding the indications of equivocal situations. In fact, practitioners may use the insights to contemplate their evaluation employment and to recognize the possible risks of equivocal situations which they should be aware of when embarking on evaluations. Our framework can thus be used to support making informed decision in a purposeful fashion for the project's next course of action. This study sets the basis for further research endeavors and contributes to the existing IS/IT project management literature.

However, there are several limitations entailed in this study. First, the number of databases included in the search strategy. Second, the chosen keywords to query. Only two databases were used for the specific queries. Some publications might have been

omitted because of these two limitations. To lessen these limitations, related articles were added by crosschecking authors and references from the initial search result. Third, not every publication selected was directly related to IS/IT projects. This is reasonable since the research area is not specific to IS/IT and is also relatively unexplored, shown by the small number of empirical evidences concerning the cause of equivocality in IS/IT projects. However, we tried to extract the common denominators from other areas which were closely related and relevant to IS/IT projects.

Further studies are needed to corroborate the potential causes of equivocality and to decipher their impact on the extent to which evaluation of a project is hampered by equivocality; also their impact on the decision to continue IS/IT projects. This could be done by eliciting practitioners' experiences within the group of evaluators or decision-makers; enabling better examination of project evaluations.

⁸ This chapter is based on a paper presented and published in the proceedings of the 2013 17th Pacific Asia Conference on Information Systems (PACIS 2013).

Abstract

Evaluating IS/IT projects and deciding on their continuation has been hampered by the problem of equivocality. Equivocal situations hinder decision-makers to clearly recognize potential problems and future implications of the decisions. The situations hence impede them to decide the course of action in a purposeful fashion. Yet, little attention has been devoted to examine the causes of such situations. Extant literature was analyzed and synthesized to identify typical characteristics of equivocal situations and uncover the potential causes of equivocality. We developed a framework based on this review and used it further to assist the investigation and to corroborate the causes of equivocality through interviews with experts. In this chapter, we investigated the causes of equivocality in practice by eliciting insights from different perspectives of decision-makers and their perceptions on equivocal situations. We found that the prevailing equivocal situations were much strongly related to the Challenges in project management, the Complexity in process, and the Sophistication of technology within the Content of evaluation. Intriguingly, we found less solid relations with the Lack of standards and the Failure of evaluation methods as these two factors did not emerge as dominant causes during our discussions with the experts.

3.1 Introduction

It is highlighted earlier that as new information related to the projects is received during project execution organizations need to evaluate projects that have already been justified to ensure why they should continue supporting them (Seddon et al. 2002; Snow and Keil 2002a; Thompson et al. 2007). However, past studies have underlined the difficulty in evaluating projects' progress and the tendency to get trapped in equivocal situations. This particularly concerns with whether the expected benefits of continuing the projects still outweigh the realization costs (Abdel-Hamid et al. 1993; Mähring and Keil 2008; Tarek K 1988). Examination on project reports by Snow & Keil (2002a) and (2002b) indicate that information related to project execution often raises ambiguity when evaluating the projects.

Furthermore, research pertaining to the causes of equivocal situations is still limited. Earlier studies are particularly focused on examining the project appraisal methods (Chulkov and Desai 2008; Keil and Flatto 1999; Taudes et al. 2000; Tiwana et al. 2006; Tiwana et al. 2007). The causes of equivocal situations are hence pointed solely to the drawbacks of traditional capital budgeting techniques. Despite the depth of understanding gained from these studies, still the issues of equivocality should not be seen from a single viewpoint. Thus, it still remains arguable why evaluation of the on-going IS/IT projects are hampered by equivocal situations and what factors that would possibly lead to such situations. This chapter endeavors to fill this gap by addressing the following research question:

Why do equivocal situations occur when evaluating and deciding on the continuation of on-going IS/IT projects and what are the causal factors?

First, the equivocal situations and a-priori set of potential causes are defined based on the concept of equivocality from extant studies. Second, a framework to investigate equivocal situations in practice is formed by linking literature from IS/IT evaluation and IS/IT project continuation decisions. Third, the causes of equivocality when evaluating and deciding the continuation of on-going IS/IT projects are investigated using extensive interviews with experts based on the framework drawn from Stockdale and Standing (2006), an extension of the content, context, and process (CCP)

framework and of Goldkuhl and Lagsten's (2012) conceptual practice model of evaluation (CPME). Insights on equivocal situations are gleaned from the perspectives of different decision-makers or stakeholders. We aim at empirically examining equivocal situations to corroborate and refine the a-priori set of equivocality causes in the context of IS/IT project evaluation. This chapter represents the second stage of exploratory phase (theory development and model building).

3.2 Related Research

The utilization of appraisal or evaluation methods and techniques is recommended when describing the realization of organizational resources for their merit and worth; this process of justifying the investment expenditure through judging and comparing a set of suitable contextual standards is known as project review or evaluation (Irani et al. 2005; Remenyi et al. 2007). The evaluation, which shows the past performance and the future attainment of projects, is a reference point when making continuation decisions (i.e., deciding escalation or abandonment) (Snow and Keil 2002a; Thompson et al. 2007). Equivocal situations, instigated by what Bowen (1987) termed as equivocal information, are posited to prevail in IS/IT project evaluations leading to improper decisions and further debacles.

The studies of equivocality in psychology have used experimental settings to examine effects of equivocality on escalation and abandonment decisions (Bragger et al. 1998; Bragger et al. 2003). However, the main limitation of these studies is that they did not specifically examine the causes of equivocality. In these studies, equivocality was a given independent variable and was manipulated in the experiments; thus, the causes of equivocal situations still remain a question mark. Furthermore, most studies concerning equivocality in IS/IT project mainly focused on the common use of capital budgeting techniques (Chulkov and Desai 2008; Keil and Flatto 1999; Taudes et al. 2000; Tiwana et al. 2006; Tiwana et al. 2007). Evaluations using these techniques are argued of having a tendency to systematically underestimate the true value of the projects (Keil and Flatto 1999). Difficult quantification of benefits associated to the projects has caused the techniques not always adequate to evaluate such projects, as they are likely to create misperception on the projects' worthiness. Real option theory is suggested to view IS/IT investment and to balance the traditional cost-benefit measurement of the projects

(Chulkov and Desai 2008). In certain cases, escalating a project is needed and considered to be rational based on this view (Tiwana et al. 2006).

Still, these studies have several limitations. First, the studies have been limited to a single appraisal/evaluation method (i.e., traditional net present value – NPV as a capital budgeting method). There is a series of techniques and tools taxonomies for conducting evaluation beside the traditional capital budgeting methods in IS/IT literature. It is reported that using a combination of techniques will alleviate deficiencies from the utilization of a single technique (Love and Irani 2001; Milis and Mercken 2004). Causes of equivocality are hence often linked to drawbacks of the traditional capital budgeting techniques. Second, previous studies have not specifically examined the underlying causes of equivocal situations in practice through IS/IT evaluation lens. The practice of evaluation aims to assess particular type of IS/IT projects and typically covers (1) the establishment of criteria to be measured; (2) the utilization of techniques and tools to analyze and compare the criteria; and (3) the requirement of particular project data; as well as (4) the involvement of diverse decision-makers or evaluators in the process (Bowen 1987; Farbey et al. 1995; Serafeimidis and Smithson 2003; Stockdale and Standing 2006). These elements need to be incorporated in the following studies.

3.3 Research Methodology

The study was conducted in two parts. First, a literature review of publications examining equivocality and IS/IT project evaluation/decision was conducted to build a theoretical foundation for the concept of equivocality, an equivocal situation, and its causes (cf. Chapter 2). Second, semi-structured extensive interviews with experts were conducted to: (1) examine why and how equivocal situations are hampering the evaluation and decision of the on-going IS/IT projects; (2) gain insights of factors that would possibly lead to the situations; (3) corroborate and refine the a-priori factors identified in the literature review; and, (4) elicit the information needed to assist and support the design of the next confirmation phase study.

Preliminary introductions of the study, which are specified the requirements and the value of the study, were sent to potential organizations. Additionally, an initial web-based questionnaire link was also sent to the potential and interested interviewees. The interviewees were first asked to complete this initial web-based questionnaire before

the on-site interviews. They needed to recall one of their challenging IS/IT projects. Their experience in managing and reviewing particular evaluation aspects or areas were shared using this questionnaire. The initial questionnaire was opted to attract potential interviewees and draw their attention to a particular project, which will be discussed further in the interviews.

The appropriateness of the projects and interviewees' profile was briefly reviewed. The following criteria were used to select the suitable interviewees and their projects: (1) the projects were considered as IS/IT projects and had already been evaluated; (2) the interviewees were involved in the evaluations; (3) the relative years of interviewees' experience in their industries; and, (4) the interviewees' position, both in the organizations and the projects. It is important to obtain multiple perspectives to enable triangulation. The identified potential factors, which will affect equivocality in project evaluations, may largely depend on the persons who describe the situations. Different stakeholders may view equivocal situations from different perspectives; this spawns the need to triangulate by approaching multiple stakeholders.

Next, follow-up schedules for face-to-face interviews were sent to the interested interviewees together with brief overviews of the study and the interview content. Each of the interviews took approximately 1-1.5 hours. The interviews were recorded and research notes were taken properly. The interviews were transcribed and sent to interviewees whether clarifications of unclear matters were needed. Afterwards, the transcriptions were coded and analyzed using the same approach as we did for the literature review (cf. Chapter 2). The researcher interpreted and analyzed the transcriptions using the initial framework through an iterative process. This was done to have a deeper scrutiny of the emerging causes of equivocality as well as to enhance the framework itself. Through this approach, the causes of equivocality and the a-priori identified factors were corroborated and refined based on the insights from the extensive interviews with experts.

3.4 Theory Development - Insights from the Interviews with Experts

Eight categories of potential causes of equivocality are formed as described in Chapter 2. These are (1) Complexity in process; (2) Sophistication of technology; (3) Challenges in project management; (4) Lack of standards; (5) Changes in external state;

(6) Different frames of reference refers; (7) Failure of evaluation methods; and, (8) Lack of evaluation data. These 'causes' categories are posited to induce equivocality in project evaluations and may affect the decisions of the projects. Several causes often lead to difficulty in accomplishing the project. The causes may be found during the development phase and 'imported' to project evaluations. We used the insights from the literature review and the developed framework to design an initial semi-structured interview protocol (cf. Chapter 2 and Figure 6).

In the interviews, the four characteristics of equivocality were explained and used to describe and pinpoint the interested situations. This explanation gave an idea of condition that closely resemble equivocal situations during IS/IT project evaluations. The interviewees were asked to recall one of the projects which its review or evaluation endured the characteristics of equivocal situations. The structure of the interview allows interviewees to narrate their experience when evaluating the chosen IS/IT projects and to express their views on the equivocality causes based on the initial framework.

To gain insights from a wide-ranging perspective among different decision-makers or stakeholders, seven experts were interviewed from four different projects. Most of them have more than ten years of experience in their industries. They work for medium- to large-sized organizations within healthcare and government sectors. Their roles in the projects cover diverse positions in project management structure, such as corporate or program management, project board, project manager, as well as delivery team. In most cases, the evaluation and decision-making were conducted in relatively small teams. The size of the teams and the people involved would be relatively depend on the nature of the projects (Fitzgerald 1998). The types of projects range from a development and an implementation of Electronic Health Record (EHR) in a large academic hospital to a development of intelligent/smart digital forms in a governmental office. The projects have undergone comparable decisions (i.e., continuation with additional resources); however, opinions on the actual implementations (i.e., degree of success) were quite different. The projects' duration range from 1 to 3 years and one of the projects is still running at the time of interview. The chosen projects were mostly above the average scale compared to other IS/IT projects undertaken in their organizations. This scale is based on relative size (i.e., impact, budget) and duration.

Table 5 summarizes the roles, the projects, and the number of participants involved in the interviews.

Table 5. Roles, projects, and number of participants.

Role	Project	Number of participants
Corporate or program management	A, B	2
Project board	A	2
Project manager	A, C	2
Project team	D	1

We went through their experience using the aforementioned framework to corroborate and refine the a-priori set of equivocality causes. Most of the factors in the a-priori set were mentioned explicitly and implicitly by the interviewees. However, there are several dominant factors (Table 6). We discuss our findings based on the framework in the following sections.

3.4.1 Content

The content of evaluation refers to the constituents within the ‘what’ of evaluation. The identified causes within this frame are Complexity in process, Sophistication of technology, Challenges in project management, and Lack of standards.

Complexity in process. Most of the interviewees referred to this factor during the discussion. Noteworthy problems related to this factor were identified. First, the problem was the result of a lack of knowledge regarding the organizations’ internal process. Second, the problem was the result of difficulty in dealing with large groups of stakeholders. This included the existence of a dominance stakeholder. Third, the problem was related to the challenging technical aspects to realize the intended IS/IT. Finally, the problem was caused by a lack of experience with the innovation involved in the IS/IT project. One of the project managers admitted: “[The situation] was actually [occurred because] the [number] of stakeholders is too big to organize in that certain time limit.” In another project, one of the corporate managers added: “One of the reasons is that our internal organization is very complex, so to make [the project] you need, let me think, one, two, three, four, five, six, at least six different business units I would say. Quite big business units, [which] all have

their own managers and their budget cycles, and their own planning cycles and their own portfolio cycles, so that's one of the reasons."

Sophistication of technology. This factor was one of the most factors referred by the interviewees as well. The problem was rooted in the involvement of new or cutting-edge information systems and technology, which heavy in innovations or new ideas. A lack of invaluable exemplar of the systems or technology was also revealed as part of the problem. This problem was shown leading to erratic and diverse views on the information systems/technology concept and theme. As one of the program managers admitted: *"[the conflicting interpretations were happened] because we're talking about [a theme of information systems] and if you ask ten people what is your definition about [the theme], you will get ten different opinions, so everyone has expectations [based on their own view of the theme]. I think if you talk to suppliers or you talk to [name of an institutional stakeholder] or you talk to [another name of stakeholder]; they have all a very different kind of idea of [the theme]."* The project manager underscored: *"There is no other project that [is] comparable with our project in [the] whole [name of a region] based on [the theme]". "...But all the other regions are coming to us and asking how we do it."* Likewise, one of the project boards commented: *"...but in the same time no body who's really investing in it, we were able to invest in it, and what you see [now], we are very early with [the] discussion but too early."* In another part: *"...one of the most interesting [things] because it was uhm, we were very pioneer[ing], ahead of the discussion in [name of a region], but it had some interesting things to deal with."*

Challenges in project management. Most of the interviewees referred to this factor as a cause of the equivocal situation they had. Noteworthy problems related to this factor were identified. First, the problem caused by the undefined project charters. For instance, undefined project charter may allow the existence of different agendas and objectives among the project stakeholders within one single project. Second, the problem was the result of difficulty in specifying the requirements as well as in keeping up with their changes. Third, the problem was the result of a gap in perception or expectation among project stakeholders, which possibly rooted in the intangible nature of IS/IT products. The intangibility of IS/IT products makes their form challenging to be expressed or communicated precisely (e.g., between users and developers). It is also challenging to display the products seamlessly and impeccably (e.g., prototypes) without chances of discovering any faults in the future usage. Finally, the problem was related to

dysfunctional project teams as one of the corporate management admitted: *“..but well, if you have a not very experienced project manager which is in this case, what is going on, then the one who is doing his executive role can't play his or her part either, so then it's like the beginning of the end because without smart roles and without well written down project descriptions, and no reports, then yeah, these things start to evolve, and the funny part is every expert wants to do the best, but like all together they just make suboptimal products.”*

Lack of standards. Experiences of using evaluation criteria or standards were shared by the interviewees, specifically when evaluating aspects of costs, benefits and risks. Most of the interviewees felt that they did not face significant equivocal problems when evaluating costs. However, most of them felt to a certain extent the presence of equivocality when evaluating risks and benefits. A noteworthy problem is that particular types of IS/IT projects were more difficult to extract their value, as one of the project managers underlined: *“The outcome of the project was not good measurable [whether] it has the right outcome, because it was quite [an] innovative project, when you [are] working on [a theme of information systems], you cannot make a simple decision based on money, because your return of investment in this certain moment is quite unclear, and that is the problem with innovations, based on which outcome you make your decision to stop the project or to go along with it.”*

3.4.2 Context

The context of evaluation refers to the constituents within the contextual setting of the organizations. The identified causes within this frame are Changes in external state and Different frames of reference.

Changes in external state. Several interviewees expressed how this factor was affecting the equivocal situations they had in different forms, such as corporate politics, changes in regulations, pressures from outside of the project management structures, and pressures from particular emerging technology or software markets. One of the project board members expressed: *“[the conflicting interpretation on how to do the project] makes it sometimes hard in the decision-making path, when you say okay we [are] clear that situation A is better than B, but B will be chosen, and that's politics, hard to explain why, but there're some power in that kind of [stakeholders].”* In another project, one of the corporate management commented *“..there're a lot of political pressures as well in the project [which] makes people quite nervous [be]cause of [the] political pressure.”*

Different frames of reference. Many interviewees referred to this factor during the interviews. The problem was the result of heterogeneity of the involved decision-makers or stakeholders (e.g., different user groups, diverse organizations or companies, and different knowledge backgrounds). One of the project managers commented: *“You have different stakeholders and different user groups, and they have different [backgrounds]. So their evaluation is different. So you have conflicting interests during that project.”* In another project, one of the project boards expressed: *“The project was a big project with a lot of stakeholders from different companies with different approaches, different views on one hand, and the other hand. Even so, [it] was one big project with a lot of small sub-projects.”* In another part, the project board commented: *“I have seen this [one of equivocal situation characteristics], [it] seems [the] problem [occurred] because other stakeholders had a lot of problems to understand the technical side of the project [because of their limited knowledge]. If you don't have knowledge about architecture it is hard to understand architecture. So, that was sometimes hard to exactly give them the right information to make the decision.”*

3.4.3 Process

The process of evaluation refers to the constituents within the ‘how’ of evaluation. The identified causes within this frame are Failure of evaluation methods and Lack of evaluation data.

Failure of evaluation methods. None of them specified certain methods to appraise different evaluation aspects or criteria when reviewing the projects. It was argued that utilizing the evaluation methods was problematic for projects with heavy innovations, as one of the project managers highlighted: *“..measuring success of innovation, how you wanna do it, making a return of investment, forget it, it's not gonna work.”* There was also a sense of simplification related to the evaluation process. In a different project, one of the project managers admitted: *“..so I tried to balance, actually it's a mixed of impact of the problem and the size of the problem, it's not an official tool, but that's about what I did.”* Additionally, it seems that the evaluation methods were not appealing to use or they were reluctant to utilize them, as one of the corporate management commented: *“No no, nothing.. no, no there was a zero method here. Yes [we have a certain method], just choose not to use it, of course [it] is there, we have everything, all methods all tools.”* However, most of them acknowledged that they used a particular methodology in managing their IS/IT projects,

such as PRINCE2, and adhered to these methodologies by reviewing their on-going projects.

Lack of evaluation data. This factor was referred less frequently by the interviewees. They expressed several problems related to this factor when formulating the decisions, such as the availability, the sufficiency, and the provision of data/information with regard to the right level and the right detail. One of the corporate management expressed: *“There was an evaluation moment, but there [were] really very [few] materials to make the umh that you could use to make a decision.”* In another part: *“..so the decision had to be made, but well actually we didn't have enough data to decide upon, so it was more a feeling, more like experience, always sound very great, experience-based solution.”* In another project, one of the project boards admitted: *“We tried to play it as open as possible, but it's not always possible, it is always hard to be sure that it is the right information, you don't want to put things behind so they don't know.”*

Table 6. Dominant causes of equivocal situations across the projects.

Causal factor	Project			
	1	2	3	4
Content				
Complexity in process		v	v	v
Sophistication of technology	v	v		v
Challenges in project management	v	v	v	v
Lack of standards				
Context				
Changes in external state		v	v	
Different frames of reference	v	v		v
Process				
Failure of evaluation methods				
Lack of evaluation data		v	v	

3.5 Conclusion

Although most of the factors in the a-priori set were mentioned explicitly and implicitly, we found that the prevailing equivocal situations during IS/IT project evaluations were much strongly related to the categories of Challenges encountered in project management, Complexity in the process and Sophistication of the technology within the Content of evaluation. Moreover, within the Context of evaluation, the category of Different frames of reference has a substantial contribution to induce equivocality. Within the Process of evaluation, the Lack of evaluation data category has a fair contribution to the problematic situations occurred when evaluating IS/IT projects. Intriguingly, we found less solid relations with the Lack of standards and the Failure of evaluation methods categories as these two factors did not emerge as dominant causes during our discussions with the experts.

Moreover, the problems emerged from the analysis were mainly related to the unique nature of IS/IT products or solutions and linked to the challenging processes to realize them. These problems, such as difficulty in requirements and intangibility of work process and output, are somewhat connected to the innovativeness of the intended IS/IT. In one of the projects, the Sophistication of technology was the initial and the primary driver of equivocal situations. The innovative nature of the IS/IT has influenced the other causal factors and given ample of equivocality into the project and its evaluation. The prevailing equivocal situations were even amplified by the fluctuations of external environment outside the project (Changes in external state). The Sophistication of technology was (1) making difficulty in composing the project charters and fluctuating the requirements (Challenges in project management), (2) rising more intricacy in realizing the product (Complexity in process), and (2) increasing the diverse views of stakeholders in the evaluation (Different frames of reference).

However, the challenge in this study is that the causes seem interrelated and intertwined, which may be problematic to isolate and determine their superiority. The selected organizations within healthcare and government also limit the generalizability of the findings. The contribution from this study is the refined framework that maps and shows how equivocal situations might emerge when evaluating and deciding the IS/IT projects. The understanding of the equivocality concept and causes, which have been corroborated in this study, will make a contribution to the existing project management

literature. The findings will provide the basis for further research endeavors as we have elicited relevant information during the data collection to assist and support the design of the next confirmation phase.

Chapter 4. Evaluating IS/IT Projects: Emergence of Equivocality in Practice⁹

⁹ This chapter is based on a paper presented and published in the proceedings of the 2013 19th Americas Conference on Information Systems (AMCIS 2013). The paper has won the Best Paper Award.

Abstract

Equivocality has been indicated as the problem instigating erratic and hasty decisions of escalation and abandonment of on-going IS/IT projects. However, research pertaining to the emergence of equivocal situations in practice is still limited. Extant literature is analyzed to develop an a-priori set of potential causes and a framework for examining equivocal situations using case studies. Three major findings are underscored. First, the emergences of equivocal situations were associated with the problematic nature of information concerning the project's condition or status, the diverse interpretations of the evaluation objects, and the limitations of data and information to support decision-making. Second, the object of evaluation within the Content of evaluation is found to be the most critical part to induce equivocal situations in IS/IT project evaluations. Finally, the potential elements that can be used to indicate the equivocal situation causes are highlighted.

4.1 Introduction

Continuation of projects that typically exceed their initial budget and schedule by giving them additional resources (e.g., time, money, staff) and/or reducing their initial requirements is well-known as project escalation. Conversely, termination of all activity of the projects before their full implementation is referred as project abandonment (Ewusi-Mensah and Przasnyski 1991). Exemplars of IS/IT projects which suffer escalation and even end up with abandonment are mentioned extensively in the literature (Ewusi-Mensah and Przasnyski 1991; Mähring and Keil 2008; Newman and Sabherwal 1996; Oz and Sosik 2000).

Prior studies in the escalation literature imply that the phenomenon represents a flawed decision and an error in decision-making formed by psychological factors. An alternative school of thought comes from Bowen (1987). In his seminal works, he posits that the phenomenon occurs when decision-makers are confronted with equivocal situations, so that additional resources may give the project a chance to be implemented successfully (Bowen 1987; Keil and Flatto 1999). According to this view, abandonment occurs when decision-makers are in an unequivocal situation, which additional resources will clearly not result in the expectations being met.

To decide the continuation of the on-going IS/IT projects, organizations need to support their decision-making, i.e., based on the so-called project reviews or evaluations. Thorough evaluations are opted not only to appraise the worthiness of continuing the projects but also to allow intervention of projects which deviate from their plans (Seddon et al. 2002; Snow and Keil 2002a; Thompson et al. 2007). However, research on how equivocal situations emerge when evaluating and deciding the projects' next course of action in practice is scarce. Causes of such situations are not well-understood. Based on this gap, specifically, this chapter endeavors to answer the following research questions:

How do equivocal situations emerge when evaluating the on-going IS/IT projects in practice and what elements can be used to indicate the cause of such situations?

First, the term of equivocal situations and a-priori set of potential causes are defined and identified using literature review. Second, a framework is built based on the

literature and refined using extensive semi-structured interviews with experts. Third, using the refined framework, the emergences of equivocal situations are investigated by means of case studies. Insights from different cases were gleaned from empirically examining the emergences of equivocal situations in practice. Additionally, the elements to indicate such situations are elicited from the participants of the case studies.

4.2 Related Research: IS/IT Projects Evaluation and Continuation Decisions

Bowen (1987) coined the term of equivocal information which refers to information for which multiple (positive or negative) interpretations can be constructed. According to the theory, equivocal situations may lead to escalation caused by the belief that commitment of additional resources is economically prudent (Bowen 1987). Escalation occurs when decision-makers assume that information is inadequate to suggest that additional investments will not fulfil expectations. To abandon, unequivocal negative information is essential in order to convince decision-makers that the project is no longer beneficial, implying that even additional resources would not bring success (Bowen 1987).

Willcocks and Lester (1996) developed an integrated systems lifecycle approach that connects IS/IT evaluation and management cycle. They described that *“A key element in making the evaluation cycle dynamic and effective is the involvement of motivated, salient stakeholders in processes that operationalize – breathe life into, adapt over time, and act upon – the evaluation criteria and techniques.”* (p. 283). In order for an evaluation to attain its main objectives, they recommended that:

Evaluation needs to be conducted in a linked manner across systems development and into systems implementation and operational use. The evaluation cycle posits the development of a series of interlinked measures that reflect various aspects of IS/IT performance, and that are applied across systems lifetime. These are tied to processes and people responsible for monitoring performance, improving the evaluation system and also helping to ‘flush out’ and manage the benefits from the investment. (p. 284-285)

Organizations need to benchmark and specify the consequences of their IS/IT investments (Irani et al. 2005). Notably, the necessity for organizations to maintain the balance between costs and benefits in the light of new insights from the projects is inevitable during IS/IT development and implementation (Berghout et al. 2011). Through project evaluations, organizations can obtain the description of their resources realization; however, studies of project reports by Snow & Keil (2002a) and (2002b) indicated that information related to project execution often raises ambiguity when evaluating these projects.

Past studies have highlighted problems with evaluations, especially to gauge the projects' progress, and problems when getting trapped in equivocal situations (Abdel-Hamid et al. 1993; Mähring and Keil 2008; Tarek K 1988). Several studies pointed the causes to the drawbacks of traditional capital budgeting techniques (Chulkov and Desai 2008; Keil and Flatto 1999; Taudes et al. 2000; Tiwana et al. 2006; Tiwana et al. 2007). Keil and Robey (1999) indicated that escalations may be the result of equivocal situations formed by a lack of clarity about projects' success and failure criteria. Mähring and Keil (2008) argued that escalation is promoted through equivocal situations stemmed from ambiguity in the project charter, which may be reduce by specifying well-defined goals (Lee et al. 2012).

4.3 Research Method and Strategy

We conducted this study in two parts. In the first part, a review of prior studies to define the concept of equivocality and to identify its potential causes was conducted (cf. Chapter 2). It aimed for a neutral representation and to gather a representative of proper publications from information systems discipline (vom Brocke et al. 2009). The publications were selected based on their examination of equivocality and/or their arguments regarding the causes of equivocality. A final result of thirty publications was selected and used as a basis for this study (cf. Table 2).

In the second part, case studies were mainly conducted to investigate the emergence of equivocal situations in practice. We consider case studies as an appropriate method to further examine the practice of evaluations and continuation decisions using our framework. Case studies are suitable for the following reasons: firstly, through their iterative characters and strong links to the obtained data, case studies are well-known for

their strength of discoverability from which valuable insights can be gained (Benbasat et al. 1987; Eisenhardt 1989; Gable 1994). This is suitable since the research is aimed to examine evaluation practices that are potentially hampered by equivocal situations. Secondly, case study research is an appropriate method to engage in theory building or constructing conceptual frameworks as well as in hypotheses development for novel areas, which can be further tested or extended using experiments or surveys (Benbasat et al. 1987; Eisenhardt 1989).

Lastly, the case study method is suitable for practice-based problems due to its capability to elicit rich data from the participants, which will provide understanding of how equivocal situations manifest in the context of IS/IT project evaluation. Yin (1994) suggested that case study research has the ability to preserve rich and meaningful characteristics of a particular event. A project evaluation is a practice-based problem where practitioners' experience is important and involvement of multiple stakeholders is inevitable. Thus, case studies will provide better insights into the interesting events (i.e., equivocal situations and evaluation practices).

The cases are, therefore, expected to provide insights and evidence of equivocal situations as illustrated by the framework. A minimum of two sources is required to provide multiple perspectives and reduce bias toward the phenomenon. The participants were selected based on their involvement in the process of IS/IT project evaluations and continuation decisions. The sources should consist of, at least, primary decision-makers who justify, monitor or determine the projects' next course of action at strategic level as well as the ones who focus on accomplishing the projects at technical level.

4.4 Findings and Discussion

4.4.1 Project Case Studies

Most of the participants have more than ten years of experience in their industries. They work in medium- to large-sized organizations within healthcare and government organizations. The evaluation and decision-making were conducted in small teams due to the nature of the projects (Fitzgerald 1998). Compared to other IS/IT projects undertaken in their organizations, the chosen projects were mostly above the average scale (e.g., impact, budget, and duration). The projects had undergone

comparable decisions, (i.e., continuation with additional resources). Table 7 summarizes the information concerning the participants and the projects.

We explained what we mean by equivocal situations through a series of statements to the participants. For instance, we used the statement of ‘decision-makers seemed lacking clarity and understanding of the project’s condition, which created confusion concerning the project’s course of action’ to define and pinpoint the appropriate situations. We asked them whether they recognized the characteristics of equivocal situations during their project evaluations.

Each of the interviews took approximately 1-1.5 hours. The interviews were recorded and research notes were taken. The interview transcriptions were analyzed based on the framework. Documents about the projects and the organizations (e.g., project charters, presentation slides, evaluation reports, organizational charts) were also used in the analysis to increase consistency of the collected information and to make triangulation. This qualitative analysis was comprised of more than 100 pages of transcriptions and supporting documents. Through this approach, the emergences of equivocal situations were analyzed and insights from the cases were noted.

Table 7. Participants and the projects.

Project	Duration (Year)	Sector	Total number of participants	Role description
A	3	Healthcare	4	Corporate or program management: 1 Project board: 2 Project manager: 1
B	3.5	Healthcare	2	Corporate or program management: 1 Project manager: 1
C	2	Healthcare	2	Corporate or program management: 1 Project manager: 1
D	2.5	Government	2	Corporate or program management: 1 Project manager: 1

Project A

The participants expressed the emergence of equivocal situations in different ways; however, the commonality can be noted. First, all the participants seemed to feel the problematic nature of information concerning the project's condition or status. This is due to (1) the involvement of a large number of stakeholders and the implementation of a large number of sub-projects, and (2) the limited knowledge or understanding of the stakeholders on the information systems and the project itself. One of the participants underlined "*The project was so big and [had] so many sub-projects; it was sometimes hard to understand the exact phase it was [in].*" In another part "*...so you have to inform them, okay, what's [a term of an important aspect of the systems]? So I don't know what they want to know and I don't know what they need to know, so that is sometimes hard to know exactly what information is needed, for me it was sometimes hard to understand all the [sub-] projects, they had the same problem as I had [,that is,] to inform them on the right way and they had the problem to inform me on other sub-projects, and that's something more about knowledge.*" We consider this particular problem is more associated with content and context of the evaluation (i.e., Complexity in process and Different frames of reference).

Second, the participants seemed to have problems with interpretations of the evaluation object, which may be caused by (1) a lack of 'real' goals and (2) the innovative nature of the technology. One of the participants admitted "*We haven't had very specific goals; such specific goals were not set.*" The participant resumed, "*...along the way [we were] seeing how it evolved, so there weren't very smart goals to start with.*" In another part, "*I made several attempts toward the [project] to make [the] goals more specific, there're quite some reports about it, but it is [did] not [really become] specific, no, it was still a bit [of a] vague project.*" Another participant remarked, "*...because we're talking about [a theme of information systems] and if you ask ten people what is your definition about [the theme], you will get ten different opinions, so everyone has expectations [based on their own view of the theme]. I think if you talk to suppliers or you talk to [name of an institutional stakeholder] or you talk to [another name of stakeholder]; they have all a very different kind of idea of [the theme].*" We consider this particular problem is more associated with the evaluation object, i.e., the Challenges encountered in project management and the Sophistication of technology within the content of evaluation.

Project B

The emergence of equivocal situations in this project is characterized by the problem of information and, to a certain extent, the existence of multiple reasonable solutions concerning the project's next course of action. At the corporate level, it was somewhat problematic to know exactly what information was needed or how to acquire the information to support the decisions. Interestingly, however, the characteristics were only partly recognized at the technical level. There are at least two important insights. First, the problem seemed to occur because an intertwinement of several causes: the Sophistication of technology, the Complexity in process, and the Challenges encountered in project management. This problem emerged from the object of evaluation as part of the content of evaluation and was the result of a lack of experience from both the developer/implementer and the users. The project dealt with a large number of specialty groups and it was hard to define the correct point of functionality, which then caused a major change on how to conduct the project after the evaluation. One of the participants illustrated “*..[the users] have no previous experience, and that was also the problem when we started with the project, because what I [have] said, [the users] felt like they were in a shopping market, they said I want to have this, this, [and] this, now [since] they have ordered a lots and we have made a lot of [requests] for them, but they don't really use it.*” In another part, “*..but [the difficulties] became more and more clear, and during the execution of the project we said [to the users] well from [your requests] you only use three, [then, it means that] we don't need it, when you don't use it, you don't need it, so [then] we don't need to develop it. We don't have to develop it and that [it] also means that's the benefits it's not going down so fast.*” Second, the problem was more associated with the context of evaluation, specifically to the Changes in external state. The problem was related to the healthcare sector. One of the participants explained “*We have a lot of law and order, rules from the [government], and last year we have to change of the [name of a specific system] [based on the rules and regulations], and when there are such kind of changing in the rules, it costs a lot of time for IT to reorganize, and that's also a big issue in the healthcare.*” A noteworthy interrelation between the content, the context of evaluation, and the emergence of equivocal situations was underscored by one of the participants “*[The system] is most of the time [involved] high risk software, because you work with patients, it's very quick [to become] dangerous [if something goes wrong].*” In another part, “*..when you look into medical software when something is wrong with your software,*

it could give high risk for patients' health, so that [it] will also give you a feeling about the way we're testing our software, the way we test our software in our project is a very important part because it's your assurance for the patients."

Project C

The emergence of equivocal situations in this project was pointed to the lack of clarity and understanding of the project's condition. Unrealistic expectations in the planning and the perceived pressure to replace the legacy system at once were mentioned as one of the drivers to induce equivocal situations. One of the important problems was the inherited complexity of the project. The participants described the interrelationships among numerous departments and the enormous details of system functionalities, which caused difficulties in realizing the intended IS/IT investment. There were also several major setbacks during the project, which seemed to be pointed to this problem. One of the participants explained *"..yeah different department but mainly the work process that what you are looking at because we have different groups of users and you have different work processes and in this work processes they are the owner of that process, the main part of that process, so we check for all these aspects that why I say its multiple and potential conflicting."* In another part *"...it's more like there're so many aspects in what you're doing, that you [need] one overview to make a good decision, that's the main goal of this one, you should be sure that every aspect is covered for every user group or every aspect that important for this part, so that you have a clear state of where are we huh, is it okay [?] or is it almost okay [?] or is it not acceptable at all and you have the different [opinions of] groups in that way."* The problem with data provision was also described as the causes of equivocal situations. One of the participants remarked *"What's mentioned here like objective data, there's not much objective data, [at] one point you have some objective data is that you have your test protocol and you can state what tests are covered and [which are] successful, there you have some objective data, but that's same more like a detail compare to this whole overview of what you're all doing, [the] protocol [is] only covering some of these aspects in this area but not of the whole picture."* We consider this particular problem is well associated with the complexity of process within the content of evaluation.

Project D

A major problem, which induced the emergence of equivocal situations in this project, was the limitation of information and ‘tangible’ data to support decision-making. Further examination of the problem revealed several reasons: (1) project team dysfunction, specifically occurred between the project leader and the team members. The difficulties were particularly caused by a lack of certification and knowledge in project management as well as the absence of a ‘real’ team; (2) uncommitted/low commitment of the project board; and, (3) complexity of the internal processes and inadequate knowledge to understand and comprehend such various processes. One of the participants conceded “*Yeah well definitely the data, very limited data, that's really what happened, so the decision had to be made, but well actually we didn't have enough data to decide upon.*” In another part, “*...if there is not so much information, then the information you have could be multiple interpretations.*” One of the participants expressed “*[The project leader] couldn't involve or [make] the project board members [committed], and the project board members well I think they, yeah, they had also kind of lack of interest [in the project].*” In another part, “*There was no commitment of [the] project board, there was no communication, there were no plans, so there were no plans for uhm go-no-go for the project board, most of it was in the head of the project manager that time, and the project board well didn't manage the project manager, so they accepted everything and yeah they were not committed, that's the point.*” One of the participants illustrated “*..so there's a lot of stakeholders, internal stakeholders, and the internal process to make IT [solutions] is also very difficult, it's a very long process with a lot of steps and lots of stakeholders in the process.*” We consider this particular problem is well associated with the evaluation object, i.e., Challenges in project management and complexity of process within the content of evaluation.

4.4.2 Cross Cases Analysis

Based on the employed semantic differential scales during discussions, more than half of the participants felt the information they used for decision-making was less complete and less clear, and somewhat not convincing. From their general experience, more than half of the participants often found the characteristics of equivocal situations when evaluating and deciding IS/IT projects. They felt that in such situations the courses of actions were usually leaner toward escalating the project (continuation with

additional resources). Moreover, the experiences, particularly when evaluating aspects of costs, benefits, and risks, were shared by the participants. Most of the participants felt that they did not face significant equivocal problems when evaluating costs. However, almost all of the participants felt to a certain extent the presence of equivocal situations when reviewing risks and benefits. Specifically, the participants had experience of having more than one reasonable conclusion when reviewing benefits and risks. Likewise, the participants had experience of having different interpretations of the provided information in risk evaluations.

Furthermore, we provided a set of proposed elements as indicators to specify each of the potential causes. There were at least two indicators discussed in each cause. After perusing the causes' definitions and examining the proposed indicators, the participants discussed their views based on their experience. They expressed their agreement whether the causes influenced the situations they had and whether the proposed indicators existed for each case. They also expressed the importance of the causes through the semantic scales. Due to limitation of the interview duration, we were only able to elicit views from seven participants; however, we had at least one person giving his/her view in each project. Table 8 shows the relative agreement and importance across causes. Summary of the discussion are described as follows:

Complexity in process. All of the participants expressed their full agreement and importance of this factor. Three pointers that can be used for this factor are (1) the opinions of prominent stakeholders on how the complexity of the project was (e.g., whether the project was more or less complex than any other projects they had undertaken); (2) the number of people or departments and even organizations that involved in the project; and, (3) the extent to which the project was more intra or inter departmental or organizational.

Sophistication of technology. The participants felt that the factor was affecting the situations they got; however they thought it would be less importance. Two pointers that can be used for this factor are: (1) the extent to which the project involved innovations/new ideas or technology that has not been used/developed before, and (2) the primary purpose of the IS/IT, (e.g., whether the project was more business transformation-like or strategic systems or it was more automation or mandatory changes).

Challenges in project management. Almost of the participants expressed the agreement and the importance of this factor. Further pointers that can be used are (1) the extent of project charter clarity; (2) the extent of requirements stability; (3) the extent of project management effectiveness; and, (4) the extent of expectation clarity between initiators/users and developers on the scope of the project and the final system capabilities/limitations.

Lack of standards. This factor was less supported by the participants, both in terms of agreement and importance. Still, two pointers that might potentially useful are (1) the clarity of organizations' criteria of success and failure, in relation with the project; (2) the extent to which the used criteria were plausible to show past performance of the project; and (3) the extent to which decision-makers agreed with or reached consensus of using the criteria.

Changes in external state. This factor was relatively supported by the participants. Three pointers that can be used are (1) the extent to which the project was highly influenced by favorability of business condition; (2) the extent to which corporate politics, restructuring, or changes in organizational management have a significant effect on the project; and, (3) the extent of importance of having the latest technology/system. Additionally, a less supported pointer is the extent to which the project was critical to the technological or business requirement trend.

Different frames of reference. This factor was less supported by the participants, both in terms of agreement and importance. Still, three pointer might potentially useful are (1) the extent of decision-makers heterogeneity in terms of their functional backgrounds; (2) the extent to which different stakeholders were involved in making final decisions; and, (3) the extent of the occurrence of fresh people or new members during the project.

Failure of evaluation methods. This factor was less supported by the participants, both in terms of agreement and importance. Likewise, the pointers were not adequately supported by the participants.

Lack of evaluation data. This factor was relatively supported by the participants. One pointer that can be used is the extent to which the exact meaning of the data/information is either obvious or easy to find. Other pointers that less supported are

(1) the extent to which the data is at the right level or at the right level of detail, and (2) the extent of the validity and the reliability of the provided data/information.

Table 8. Participants' perceptions across causes of equivocal situations.

Causal factor	Extent of agreement	Extent of importance
<i>Content</i>		
Complexity in process	+++++	+++++
Sophistication of technology	++++	++
Challenges in project management	++++	+++++
Lack of standards	++	+
<i>Context</i>		
Changes in external state	++++	++++
Different frames of reference	+	++
<i>Process</i>		
Failure of evaluation methods	+	+
Lack of evaluation data	+++	+++

4.5 Conclusion

In a nutshell, the equivocal situations emerge from evaluating IS/IT projects in practice were characterized by the problematic nature of information concerning the project's condition or status, the diverse interpretations of the evaluation object, and the limitations of data and information to support decision-making. The object of evaluation within the content of evaluation is found to be the most critical part inducing equivocal situations during IS/IT project evaluations. Moreover, the external environment and the provision of data or information surrounding the projects within the context and the process evaluation are also supported by the case studies as the significant causes of equivocal situations.

The well supported causal factors need to be specifically examined in further study. We provide the basis of this future endeavor by eliciting the potential elements that can be used to indicate those causes and to further develop a hypothetical model. In

further examination, literature will be searched for similar constructs and comparable indicators or measurements. The findings shed light on the emergence of equivocal situations when evaluating and deciding the continuation of IS/IT projects. A model to forestall the equivocal situations and to prescribe how to deal with equivocal situations in project evaluations will be developed and tested.

Chapter 5. Equivocality in IS/IT Project Evaluation: Model Development and Pilot Study^{10,11}

¹⁰ This chapter based on a paper which is selected by the committee of the International Conference on Project Management (ProjMAN 2014) to be published in the International Journal of Information Systems and Project Management (IJISPM) with the title of Development and assessment of an instrument to measure equivocal situation and its causes in IS/IT project evaluation.

¹¹ A shortened version of this chapter is presented at the ProjMAN 2014 and published in the *Procedia Technology*, 2014.

Abstract

Project evaluations are vital for organizations to manage and balance the costs and benefits of their IS/IT investments. Despite the importance of project evaluations, equivocal situation may limit the effectiveness of an evaluation and hinder decision-makers in generating purposeful resolutions. There is a dearth of empirical studies with regard to equivocal situation, which this study addresses by developing and measuring a construct of an equivocal situation and its causes. The equivocal situation construct is derived from the notion of equivocality and its causes are extracted from the extant literature. The developed constructs are subjected to empirical validation through Partial Least Squares (PLS) analysis by employing the data collected from knowledge professionals in IS/IT project management. The developed instrument provides a firm foundation for future studies of equivocality in IS/IT project evaluation.

5.1 Introduction

Many organizations invest enormously in information systems and technology (IS/IT) and become reliant on the success of their IS/IT portfolios and projects. Charette (2005) reminds organizations of the importance to improve their IS/IT project execution due to many project failures and their related costs. Proper evaluations are beneficial to discover problems during project development and implementation. Evaluations are processes conducted by groups of decision-makers or evaluators to describe the realization of resources for their merit and worth; they judge and compare a set of standards suitable for the context, followed by decisions (Remenyi et al. 2007). The prior-justified plans and business cases can then be reestablished to maintain adequate returns of the investments, and to further proceed with well-positioned strategies (Pan et al. 2006). However, evaluations are not perceived as trouble-free practices. For instance, evaluating the progress rate of the development of an information system is problematical due to its intangibility especially during the initial stage (Abdel-Hamid et al. 1993). Hence, organizations seem to have difficulty deploying proper evaluations (Bannerman 2008).

From a research perspective, evaluating information systems and technology in organizations still remain a challenge and an interesting subject to explore. Especially as studies related to the evaluation of on-going projects are still limited. This study connects IS/IT evaluation literature to the continuation decisions of IS/IT projects. Arguably, evaluations are performed to justify choices of actions which result in decisions (Gunasekaran et al. 2006; Pan et al. 2006; Seddon et al. 2002). We introduce the concept of equivocal situations, derived from the notion of equivocality, by subscribing to Bowen's Decision Dilemma theory (Bowen 1987). An equivocal situation raises potential problems of unwarranted continuation and premature termination in decision-making and hinders organizations in deciding purposefully on the projects' next course of action (Drummond 2005; Tiwana et al. 2006). Despite the importance of equivocal situations in affecting continuation decisions, the causes of equivocal situations are not well recognized (Sleesman et al. 2012). Moreover, empirical studies of factors that affect an equivocal situation and their influence on project evaluations demand the development of a reliable and valid instrument. From a practical perspective, the instrument will provide practitioners with the knowledge to analyze their project

execution in order to lessen the equivocal situations especially at the time of evaluation. By understanding of the characteristics of equivocal situations and their causes, organizations take the first step to structure and manage their IS/IT project portfolios as well as to sustain effective project execution.

The purpose of this study is to develop and assess an instrument to measure equivocal situations in IS/IT project evaluations. The stages comprise qualitative exploration, instrument development, and quantitative assessment. The study proceeds as follows: we describe the extant studies and the relevant theoretical background on the main concepts of our study, i.e., evaluation, continuation decisions, and equivocality. Next, we describe the methodology and procedure for instrument development and assessment; we present in detail the development process, the analysis through Partial Least Squares (PLS) and the result of the developed instrument. Subsequently, we highlight our contribution to research and practice, and the entailed limitations. Finally, we conclude the study with suggestions for further development.

5.2 Theoretical Foundation

5.2.1 Evaluation

Irani et al. (2005) define IS/IT evaluation as *“a decision-making technique that allows an organization to benchmark and define costs, benefits, risks and implications of investing in IT/IS systems and infrastructures”* (p. 213). Additionally, Farbey et al. (1999) describe IS/IT project evaluation as *“a process, or group of parallel processes, which take place at different points in time or continuously, for searching and for making explicit, quantitatively or qualitatively, all the impacts of an IT project and the programme and strategy of which it is a part”* (p. 190). Evaluation can be construed as a way to manage and balance the costs and benefits throughout project execution in relation to new emerging insights of the project (Berghout et al. 2011). Thus, the aim of evaluating on-going projects is: (1) to specify the projects' progress and likely success; (2) to consider the value of continuing the projects; and, (3) to allow the intervention of projects which deviate from their plan (Seddon et al. 2002; Snow and Keil 2002a; Thompson et al. 2007). As the evaluation outcome will be the reference point of project continuation decisions and the subsequent strategies, evaluation should ascertain the project's condition unequivocally (Snow and Keil 2002a; Thompson et al. 2007). However, evaluation is challenged by the difficulty to determine

the project's condition and the equivocality of information surrounding the project (Abdel-Hamid et al. 1993; Snow and Keil 2002a; Snow and Keil 2002b; Tarek K 1988). Decisions to continue IS/IT projects become a problematic issue for organizations (Keil 1995).

5.2.2 Equivocal situation

One of the prominent theories as to why decisions are taken by organizations to continue with troubled IS/IT projects is the Decision dilemma, coined by (Bowen 1987). We subscribe to Bowen's conjecture of equivocality, referring to information for which multiple (positive or negative) interpretations can be constructed (Bowen 1987). The theory posits that continuation decisions of troubled IS/IT projects are seen more as dilemmas rather than errors of decision-making. When information surrounding the projects is deemed to be ambiguous, equivocal situations might emerge and lead to escalation (Brockner 1992). Evaluating and deciding on the continuation of IS/IT projects in an equivocal situation may lead decision-makers to an unwarranted continuation or a premature termination. Decision-makers are unable to grasp a clear picture of the likely success or failure of the projects. Decision-makers may not be able to make a purposeful decision on the next course of action. Unwarranted continuation decisions may be seen as irrational behavior, which traps decision-makers in a difficult situation. Unwarranted continuation causes the project to absorb a great deal of resources without a clear end point. In many cases, the projects often end up being abandoned or are redirected but usually too late. Likewise, premature abandonment is also considered as problematical as it may cause organizations to miss opportunities or future benefits from the investments and to lose on deployment costs (Drummond 2005). Continuation decisions, inevitably, become crucial for organizations in the management of their IS/IT portfolio.

Several causes of equivocal situations are implicitly mentioned in some studies. For instance, lack of clarity about projects' success and failure criteria, vagueness of project charter, or ambiguity of information surrounding the projects execution (Keil and Robey 1999; Mähring and Keil 2008; Snow and Keil 2002a). These are deemed to induce equivocal situations. However, extant studies have not explored the concepts of equivocality in IS/IT projects specifically, thus the phenomenon and the causes are not well understood. Evaluating the IS projects is often challenged by disagreement due to

multiple interpretation of information surrounding the project and the difficulty to establish evaluation criteria, utilize the evaluation techniques and tools, and to obtain adequate data to support the decision-making. This situation raises confusion and dilemma, as described by Bowen.

5.3 Instrument Development Process

We describe the approach taken when developing and testing an instrument to measure the extent of an equivocal situation as well as the causes of such situations (Moore and Benbasat 1991). Figure 7 depicts the stages and the employed methods to develop and assess the instrument.

Figure 7. Stages and methods for the instrument development

5.3.1 Domain exploration

In the first stage, we examined the notion of equivocality to improve our understanding of the notion and to identify its common characteristics. The literature was collected by entering the key terms: (escalat* OR abandon*) AND (information equivocal*) into two databases, i.e., EBSCOhost (Business Source Elite, EconLit, PsycARTICLES and Psychology and Behavioral Sciences Collection) and SciVerse Scopus (subject areas includes Social Science & Humanities). Equivocality is associated with multiple interpretations, conveyed meanings or perceptions with regard to particular information. Indeterminacy of analyzed data, demand of 'richer' or different types of information, and exchange of views and judgments to settle disagreement and reach consensus specify the emergence of equivocality. From that derived notion, we developed the concept of equivocal situations in the context of IS/IT project evaluations. We further defined equivocal situations in IS/IT project evaluations as the state when decision-makers or evaluators encounter a lack of clarity and confusion in deciding on the continuation of a project, which occurred due to lack of knowledge or the existence

of diverse knowledge with regard to information surrounding the project, especially its past performance and future attainment. In our initial review of the literature, we found a limited number of studies in the context of IS/IT projects which directly describe the causes of equivocal situations; thus, we extended our analysis to other similar contexts. The review included a thematically iterative process and analysis (Miles and Huberman 1994) resulting in eight conceptually substantiated categories of causes of equivocal situations. Then, we delineated the initial definitions of the categories.

5.3.2 Instrument development

In the second stage, we identified extant measurements with similarities to our categories. We constructed a pool of candidate items with high content validity by considering our initial defined categories and the identified problems of equivocality. A category was conceived as a common denominator for items under its delineated definition. The existing items which were too context specific were adapted and reworded to ensure suitability with the domain of our study. We tried to word the items in a simple and straightforward and excluded jargon or potentially unfamiliar words. Then, we corroborated and enhanced our initial development of the measurements and items using seven in-depth interviews with experts from academia and practice (Arviansyah et al. 2013b), and ten semi-structured interviews with practitioners of four project case studies (Arviansyah et al. 2013a). We opted for this action to ensure adequate content validity of the constructs and the items before further utilization. We invited experts from academia and practice who hold a doctoral degree (or a candidate) and/or have experience managing and evaluating IS/IT projects. For the project case studies, we invited practitioners who were involved in IS/IT project evaluations and decisions. A minimum of two participants is required per case to obtain different perspectives and sufficient triangulation among people within a group of decision-makers. In the interviews, we defined the equivocal situations and presented characteristics of equivocality in the context of IS/IT project evaluations. We asked the participants to recall a project with similar condition during its evaluation. We first allowed the participants to express their thoughts on the project and the evaluation; then we focused on the causes of the described condition. We provided our categories, their definitions and measurements afterwards. We asked them to comment on the categories and the measurements, and whether they could suggest additional issues or problems

that cause such a condition based on their experience. Their suggestions served as input to modify the initial items. We further requested the participants to assess the degree to which they agree with the category of the causes and their importance on affecting the described condition (i.e., the equivocal situation in project evaluation) using a 7-point scale (1 indicated a strongly disagreed/an unimportant cause, and 7 indicated a strongly agreed/an important cause).

One of the researchers transcribed and coded the interviews. The coding was then discussed with other researchers to gain additional perspectives. We consolidated our initial findings from the literature review with the results of the interviews. We redefined the categories and modified the items accordingly with the results of this stage. The aforementioned process was conducted to ensure content validity by selecting the right items for the construct based on the categories' definitions and the identified problems of equivocality. Eight categories of equivocal situation causes were established. Table 9 provides definitions of the constructs and the supporting references as well as examples of quotations from qualitative studies.

Table 9. Developed constructs

Construct	References	Quotation from qualitative studies
Complexity in process (CP): <i>the extent to which the process of developing IS/IT involves substantial intricacy</i>	Brun and Saetre (2008); Chang and Tien (2006); Fazlollahi and Tanniru (1991); Jones and Kydd (1988); Koufteros et al. (2005); Lim and Benbasat (2000).	<i>"[The situation] was actually [occurred because] the [number] of stakeholders is too big to organize in that certain time limit."</i>
Sophistication of technology (ST): <i>the extent to which the design of IS/IT product or solution is considered innovative or advanced</i>	Brun and Saetre (2008); Fazlollahi and Tanniru (1991); Kydd (1989).	<i>"There is no other project that [is] comparable with our project in [the] whole [name of a region] based on [a theme of information systems]."</i>

Construct	References	Quotation from qualitative studies
Challenges in project management (CPM): <i>the extent to which the IS/IT project encounters substantial management challenges</i>	Hantula and DeNicolis Bragger (1999); Jones and Kydd (1988); Kydd (1989); Levander et al. (2011); Mähring and Keil (2008); Pan and Pan (2006).	<i>"I made several attempts [at] the [project] to make [the] goals more specific, there were quite [a few] reports about it, but it [did] not [really become] specific, no, it was still a bit [of a] vague project."</i>
Lack of standards (LS): <i>the extent to which evaluators/decision-makers utilize evaluation criteria to ascertain the project value</i>	Bowen (1987); Brun and Saetre (2008); Chang and Tien (2006); Fazlollahi and Tanniru (1991); Hantula and DeNicolis Bragger (1999); Jones and Kydd (1988); Koufteros et al. (2005); Lim and Benbasat (2000).	<i>"..so there were no plans for uhm go-no-go for the project board.. most of it was in the head of the project manager that time."</i>
Changes in external state (CES): <i>the extent to which the project is affected by organizational environmental dynamics</i>	Carson et al. (2006); Chang and Tien (2006); Fazlollahi and Tanniru (1991).	<i>"..there are a lot of political pressures as well in the project [which] makes people quite nervous [be]cause of [the] political pressure."</i>
Different frames of reference (DFR): <i>the extent to which evaluators/decision-makers have diverse viewpoints when evaluating the project</i>	Daft et al. (1987); Fazlollahi and Tanniru (1991); Frishammar et al. (2011); Jones and Kydd (1988); Levander et al. (2011); Zack (2007).	<i>"..you have different stakeholders and different user groups and they have different [backgrounds]. So their evaluation is different."</i>

Construct	References	Quotation from qualitative studies
Failure of evaluation methods (FEM): <i>the extent to which evaluators/decision-makers apply techniques or tools to evaluate the projects</i>	Bowen (1987); Keil and Flatto (1999); Tiwana et al. (2006).	<i>“No no, nothing.. no, no there was a zero method here. Yes [we have a certain method], just chose not to use it.”</i>
Lack of evaluation data (LED): <i>the extent to which evaluators/decision-makers use data surrounding the project to support decision-making</i>	Bowen (1987); Newman and Sabherwal (1996).	<i>“There was an evaluation moment, but there [were] really very [few] materials to make the uhm that you could use to make a decision.”</i>
Equivocal situation (ES): <i>the extent to which evaluation of the project is hampered by equivocality</i>	Daft et al. (1987); Watts Sussman and Guinan (1999); Lim and Benbasat (2000).	<i>“Equivocality means ambiguity, the existence of multiple and conflicting interpretations about an organizational situation. Equivocality often means confusion, disagreement and lack of understanding”. (From literature review)</i>

5.3.3 Instrument enhancement

In the third stage, we employed two rounds of Q-sorting exercises to assess the convergent and the discriminant construct validity of the items. We followed the procedure set by Moore and Benbasat (1991). The procedure comprises a technique to specify the ‘hit’ ratio, i.e., the desirable placement of items within different constructs or categories of causes. The technique is useful to assess and measure the construct validity. The result of the two rounds of Q-sorting exercises indicates reliability of the

categorization and the items. Although some quantification can be made, the reliability and validity analysis of this procedure should be seen as being more qualitative instead of purely quantitative (Moore and Benbasat 1991). WebSort/OptimalSort online card sorting was used to conduct the sorting exercises (Figure 8). The website has features to conduct the sorting exercises remotely and simultaneously and to download the raw data swiftly (<http://www.optimalworkshop.com/optimalsort.htm>). The website also provides useful outputs such as dendrogram (Figure 9) and popular placements matrix. Different sets of participants were used in the two-rounds of sorting exercises. The participants in the first round consisted of four master students (unfamiliar with the research topic) and the second round had a combination of four doctoral students and faculty members (familiar with information systems field but not with the research topic specifically).

Prior to the exercises, we introduced our research briefly and described the objectives of the exercise. Then, the participants opened the website using their internet browsers and read the instructions. We clarified the instructions further, when necessary; when ready, we asked the participants to proceed with the exercises. The participants were provided with the categories, including one labeled 'Indecisive' for ambiguous and indeterminate items, and they had to sort or group the randomized-items into the categories. The exercises lasted 20 to 30 minutes on average for each participant. We discussed the sorting experience with the participants after the exercises; specifically, the categorization and the items within the 'Indecisive' category. We collected and analyzed the data from the first round before continuing with the second round. We constructed a matrix and calculated the inter-judge agreement levels, the computed Kappas and the 'hit ratios'. The averages in the first round were: 'hit ratios' 68%, raw agreement 69%, and Kappa 64%. Furthermore, we examined the remarks and suggestions from the participants, and highlighted several points to improve the items. For example, negative and positive expressions seemed to influence the participant decision to put items into particular categories. We made several revisions by rewording the items to fit the intended category better, especially items that were frequently misplaced and deemed as ambiguous or indeterminate. Several candidate items which were often put into more than one category were revised as well. Several items were flagged because of their potential lack of distinctiveness and convergence, for instance the item *"several of the decision-makers who evaluate the project have switched a few times"*.

Figure 8. Q-sorting exercise panel

Figure 9. Q-sorting exercise output (dendrogram)

The final modifications were employed in the second round. We repeated the calculation to measure improvement after the modification. The construct averages in the second round were: ‘hit ratios’ 86%, raw agreement 85%, and Kappa 83%. The

percentage of items placed in the target constructs were high, showing reliability of the items, which suggests the items tap adequately into the respective constructs. The overall result indicates an improvement of convergent and discriminant construct validity of the items as well as an achievement of appropriate levels of agreement, i.e., a Kappa value higher than 0.6 and a placement ratio higher than 0.8 (Moore and Benbasat 1991). In addition, we reconsidered the flagged items and items which seemed redundant conceptually or semantically. Table 10 provides a summary of the agreement measures for both rounds. Table 11 provides the candidate items used to measure the developed constructs. Based on the overall improvement of the items, we considered the measurement to be adequately valid for the next stage, i.e., application of the instrument. We then composed a draft of the survey based on the Q-sorting result.

Table 10. Inter-judge agreements and placement ratios summary

Agreement measure	Combination	Round 1	Round 2
Raw agreement	1 and 2	0.71	0.90
	1 and 3	0.68	0.81
	1 and 4	0.66	0.85
	2 and 3	0.71	0.82
	2 and 4	0.69	0.91
	3 and 4	0.66	0.81
Average		0.69	0.85
Cohen's Kappa	1 and 2	0.67	0.88
	1 and 3	0.63	0.78
	1 and 4	0.61	0.82
	2 and 3	0.67	0.80
	2 and 4	0.65	0.90
	3 and 4	0.61	0.78
Average		0.64	0.83

Placement ratios summary	Round 1	Round 2
Complexity in process (CP)	0.44	0.81
Sophistication of technology (ST)	0.50	0.94
Challenges in project management (CPM)	0.65	0.71
Lack of standards (LS)	0.67	0.88
Changes in external state (CES)	0.75	0.85
Different frames of reference (DFR)	0.85	0.85
Failure of evaluation methods (FEM)	0.63	0.88
Lack of evaluation data (LED)	0.94	1.00
Average	0.68	0.86

It is important to note the way equivocal situations were measured. The items were synthesized from the initial literature review by considering the extant studies listed in Table 11. The construct consisted of four candidate items which had more complex syntaxes and seemed to be double-barreled. Double-barreled expressions are commonly avoided in item creation since they might be considered psychometrically inadequate. This reason mainly arises from the difficulty to precisely pinpoint which facets respondents refer to and the difficulty to describe how respondents combine all the facets when generating their responses (Canary 2011; MacKenzie et al. 2011). However, longer and more complex syntaxes as well as multiple terms (or barrels) in one item have been used in certain cases. For example, (Menor and Roth 2007), (Watts Sussman and Guinan 1999), and (Carson et al. 2012) use items which are relatively longer, more complex, and contain multiple items to assess new service development (NSD) culture (*"Our firm emphasizes its human resources and places a premium on high cohesion and morale in its new service development activities"*), task ambiguity in software development projects (*"During system development, to what extent can information be interpreted in different ways, which can lead to different but acceptable solutions?"*), and top management involvement in new product performance (*"Individuals and teams settled their own disputes and came up with ways to reconcile differing views or opinions that developed"*). In these cases, the items might appear to be double or multiple-barreled; however, they are usable because (Canary 2011): (1) the use of multiple terms in one item can be interpreted as one united idea, (2)

particular items may require multiple terms for the idea to make sense and thus have to exist together. The use of multiple terms works as long as it does not make the main idea of an item confusing (Canary 2011). We consider equivocal situations as relatively complex conditions and since the studies which explore and examine equivocal situations in the context of IS/IT project evaluation are still limited it is important to define and construe the idea into these candidate items although they become seemingly longer and complex. In our case, when assessing whether the level of an equivocal situation was high or low, it is merely a concern whether the respondents considered only a particular facet existed or all the described facets existed together to a great extent or did not exist at all in the items.

Table 11 Candidate items

Item		Reference
CP1	Multiple stakeholders were involved in the development process of the project	Perceived complexity in software development (Watts Sussman and Guinan 1999). Information systems development project (ISDP) complexity (Weidong and Lee 2005). Project complexity in new product development (Ahmad et al. 2013).
CP2	The development process of the project involved a lot of integration with other systems	
ST1	The concept of the IS/IT product was very novel	Concept complexity and novelty in the new product

Item		Reference
ST2	The design of the IS/IT product involved the use of immature technology	development (Martinsuo and Poskela 2011). Project complexity in software project risks (Han and Huang 2007; Wallace et al. 2004b) Innovation in 'black swan' IS/IT projects (Wu et al. 2011a)
CPM1	The project had NOT set out project milestones adequately	Project planning and project monitoring & control in software projects (Keil et al. 2003). Requirement diversity in information systems development project (Jiang et al. 2009; Nidumolu 1995; Nidumolu 1996) Project management in new product development project (Schultz et al. 2013).
CPM2	Senior management did NOT control the project adequately in order to keep it on track	
CPM3	Ineffective communication among people in the project management structure	
CPM4	The project charter, as a basis for managing the project, was vague	
LS1	Clear and well communicated criteria for go/no-go decisions and significant resource adjustments were set by the decision-makers (reverse)	Decision-making clarity in innovation projects (Schultz et al. 2013) Formal evaluation system in innovation projects
LS2	The evaluation criteria were considered credible by the decision-makers (reverse)	

Item		Reference
LS3	A set of criteria to evaluate the project was agreed by the decision-makers (reverse)	(Martinsuo and Poskela 2011) Credibility and efficiency in innovation project proposal screening (Hammedi et al. 2013)
CES1	Changes in law, rules or regulations had a significant impact on the project	Organizational environment in software projects risks (Han and Huang 2007; Wallace et al. 2004a; Wallace et al. 2004b). Environmental volatility in new product development (Carson et al. 2012).
CES2	Changes in organizational structure external to the project had significant impact on the project	
CES3	Politics had a negative effect on the project	
CES4	Resources were shifted away from the project because of changes in organizational priorities	
DFR1	The decision-makers had different backgrounds	Team diversity in software development agility (Lee and Xia 2010). Senior team heterogeneity (Van Doorn et al. 2013).
DFR2	The decision-makers had skills and abilities that complement each other (reverse)	
FEM1	A predefined procedure was applied to evaluate the project and to decide the next course of action (reverse)	Formal evaluation system in innovation projects (Martinsuo and Poskela 2011).
FEM2	Evaluation techniques or tools were applied to evaluate the project and to decide the next course of action (reverse)	
LED1	The data used were accurate enough to evaluate the project (reverse)	

Item		Reference
LED2	It is difficult to evaluate the project effectively because some of the needed data were NOT available	Information systems users' satisfaction with the data (Karimi et al. 2004).
LED3	The data were at an appropriate level of detail to evaluate the project (reverse)	Data quality in ERP implementation (Gattiker and Goodhue 2005).
ES1	The project status or condition was hard to ascertain due to different interpretations among decision-makers of information surrounding the project	Environmental ambiguity in new product development (Carson et al. 2012).
ES2	Decision-makers lacked clarity and understanding of the condition of the project and thus were confused concerning the next course of action	Ambiguity in software development (Watts Sussman and Guinan 1999).
ES3	It was problematic to analyze the condition of the project since insufficient objective data was available to base the decisions on	Information equivocality in organizational work units (Daft and Macintosh 1981).
ES4	Decision-makers needed to exchange opinions, share meanings and beliefs toward the project to settle disagreement and reach consensus for the next course of action	Perceived equivocality in text-based and multimedia representation (Lim and Benbasat 2000).

5.3.4 Instrument preparation

In the fourth stage, we created a draft of an invitation letter and developed an online survey based on the draft questionnaire. A feature of the online survey was prepared to monitor the distribution and to capture the response data of the respondents. We tested the online survey on colleagues from academia who have knowledge of the IS/IT field via a survey link. Each person went through the questionnaire and made remarks and suggestions after completion. Several of the remarks were mostly related to the flow of the questions and the estimated time to complete the survey. Notes were

taken during the discussion to improve the easiness and the clarity of the questionnaire further. The questionnaire was comprised of two parts: the first part encompassed the questions used to investigate the equivocal situations and their causes as well as the decisions and the actual implementation of the projects; the second part questioned the respondents about themselves and their chosen projects. The questionnaire asked the respondents to recall a recent review or evaluation of a challenged IS/IT project they were involved in and to keep this one project in mind throughout the questionnaire. We mostly employed the 7-point Likert scales that typically range from (1) Not at all and (7) To a great extent, for each of the measurements. On acquiring the remarks and suggestions, several refinements were made to improve the survey, such as recasting the survey's main and section openings as well as adding questions related to the project and the respondent profile. We collected the responses of the pilot test after (1) sending an invitation to personal contacts; (2) sending and posting the invitation to several relevant LinkedIn groups; and, (3) requesting IS/IT professional organizations to partake in our survey. Around 60 people had access to the survey and 33 respondents filled the survey in completely within two weeks, in November 2013.

We created a straightforward path model between equivocal situations and the categories of causes, giving a one-level relation. Each candidate item serves as a formative indicator of the eight categories of causes (the first-order constructs) since it represents a problem of equivocality, developed inductively from the prior stages, i.e., literature review and qualitative studies (Esposito Vinzi 2010). Each category of causes is conceived as a composite construct that pulls together different facets of equivocality problems under a common denominator; thus each category is expected to be affected by the items or indicators (Cenfetelli and Bassellier 2009; Esposito Vinzi 2010). It is also important to note that the items within each category cannot have the same number since they are uniquely identified from the prior stages. Moreover, we consider the equivocal situation (ES) as a reflective construct since the items are a manifestation of the construct and are interchangeable (Cheryl Burke Jarvis et al. 2003). The eight categories of causes are posited to have a positive association with the degree of equivocal situation in IS/IT project evaluation. Eight categories of causes serve as the independent variables and the degree of equivocal situation serves as the dependent variable. Figure 10 presents the proposed research model. We further assessed the

instrument based on the data acquired in this stage using SmartPLS 2.0 (M3) (Ringle et al. 2005).

Unidimensionality of the construct of equivocal situation with reflective indicators is required to show validity and reliability. Unidimensionality is tested using Cronbach's alpha with a threshold of 0.7 (Hair et al. 2010; Hair et al. 2011). The conditions for convergent validity to be met are shown by three aspects: (1) the indicator loadings for all items are significant and fulfill the 0.7 threshold; (2) the average variance extracted (AVE) fulfills the 0.5 threshold; and, (3) the composite reliability score fulfills the 0.7 threshold (Hair et al. 2010; Hair et al. 2011). All the values of equivocal situations (ES) construct exceed the required threshold. The result shows the measurements were good quality. Furthermore, multicollinearity is a threat to the eight causes of equivocal situations using formative indicators. Multicollinearity is examined by inspecting the variance inflation factor (VIF) values, which should not exceed 3.3 (Hair et al. 2010; Hair et al. 2011; Petter et al. 2007). The maximum variance inflation factor (VIF) for this test was 2.72. This suggests multicollinearity is not a problem. We further checked the correlations between the constructs; these were below the suggested 0.71 threshold (Andreev et al. 2009), which suggests limited information concerning discriminant validity of the constructs (Andreev et al. 2009). Thus, we developed the application based on the described assessment further by adding respondents to increase the sample.

Figure 10. Formative model of the causes of equivocal situations

5.3.5 Instrument application

In the fifth stage, we collected more data in a similar way to that described before, to acquire relatively quick responses and to keep the costs low. Two IS/IT professional organizations helped with our data collection by publishing the survey invitation on their website and sending it via newsletters. A total of 111 respondents partook in our survey within a period of seven months (January-July 2014). The profiles of the respondents can be described as follows: senior managers of IS/IT or CIO (23%), project managers (21%), IS/IT managers (19%), and the rest includes non-senior or non-IS/IT managers and other roles such as consultants, auditors, etc. The top three sectors in which the respondents worked were banking (financial) (16%), IT services (14%), and

Government (13%). More than half of the respondents (52%) worked in a larger than average organization/industry.

Moreover, the profiles of the projects could be described as follows: the primary purposes are mostly strategic systems (19%) and business transformation (19%). The types of projects were: packaged software implementation (35%), in-house new development (30%), and enhancement of existing software/systems (15%). 69% of the projects were considered larger and 70% were of longer duration than other IS/IT projects undertaken by the organizations. Concerning the decision of evaluation, 18% of the projects had suffered total and substantial abandonment. 51% of the projects were categorized as escalated, and another 26 % of the projects were proceeding as planned. Around 40 percent of the projects were considered as not being over budget, 23% as not behind schedule, and 32% as not lacking requirements or required specifications.

We continued to utilize PLS with SmartPLS 2.0 (M3) (Ringle et al. 2005) since it suited the nature of our study. This is a theory-building study and at an early stage we attempted to define the equivocal situations and to identify the causes and thereby to develop an instrument to measure them. The proposed research model, which includes a mix of reflective and formative measures, is also well suited to a PLS analysis (Ringle et al. 2012). We ran the PLS algorithm to re-examine the model. Regarding the reflective items, the ES4 had a loading below 0.7 (0.55); thus, we decided to drop the item. On doing so, the conceptual domain of the construct still remain intact given that reflective items are interchangeable (Cheryl Burke Jarvis et al. 2003). Table 12 provides the loadings of the reflective items and the quality criteria of the reflective measure for the equivocal situation construct. We developed a matrix of latent variable correlations (Table 13) and generated the values of variance inflation factor (VIF) for the formative items (Table 14).

Table 12. Loadings and quality criteria for reflective measure.

Construct	Item	Standardized loading	AVE	Composite reliability	Cronbachs Alpha
Equivocal situation (ES)	ES1	0.81	0.67	0.86	0.75
	ES2	0.85			
	ES3	0.79			

Table 13 shows that none of the correlations are above 0.90 and below 0.71 (Andreev et al. 2009). The maximum variance inflation factor (VIF) is 2.69. There are two types of VIF in Table 14, i.e., the outer and inner VIF. The outer VIF shows the severity of collinearity among items within a construct; additionally, the inner VIF shows the severity of collinearity among constructs (latent variables) in the model (Hair et al. 2014). Overall, the value of the VIF suggests that multicollinearity is not a threat in our study as might be suggested by a more restrictive VIF threshold, i.e., a value of 3.3 (Hair et al. 2010; Hair et al. 2011; Petter et al. 2007).

Table 14 also provides the weights, the outer loadings, and the statistical significance of the formative items. The weights of the items show the relative importance or contribution, and the relevance of the items to the corresponding constructs (Hair et al. 2014). More than half of the weights of the items reported here are not significant; however, this does not indicate a poor instrument (Hair et al. 2014). The outer loadings, which show the absolute importance or contribution of items to the corresponding constructs, are significant except for the CP1, ST2, and CES1 (Hair et al. 2014). We opted to retain the three items this time despite less empirical support of their relevance. This was done to avoid compromising content validity of the constructs since the items stemmed from the prior qualitative studies. Moreover, the ST2 and CES1 are negative, but the correlations between items in the CES and ST constructs are all positive. Co-occurrence of negative and positive item weights may occur when a suppressor effect is involved (Cenfetelli and Bassellier 2009). High correlations occurred between ST1-ST2 (0.33) and between CES1-CES4 (0.33). The magnitude of the correlations among these formative items may invert the signs of these items (Cenfetelli and Bassellier 2009). The negative figures can be interpreted as: when all other items being equal, increased amounts of ST2 or CES1 reduce the degree of the corresponding constructs (i.e., ST and CES) (Cenfetelli and Bassellier 2009). Figure 11 exhibits the proposed model with the item weights. The figure shows the weights for each item and their significance; however, it does not display the path coefficients and the coefficient significances. We limited the assessment to the formative and reflective measurement model since this is the primary objective of the chapter. An assessment of the structural model is outside the scope of this chapter.

Figure 11. Indicator weights of the model (N=111)

Table 13. Latent variable correlations.

	CES	CP	CPM	DFR	ES	FEM	LED	LS	ST
CES	-								
CP	0.29	-							
CPM	0.25	0.17	-						
DFR	0.24	0.18	0.36	-					
ES	0.36	0.20	0.58	0.42	-				
FEM	-0.09	-0.10	0.28	0.30	0.22	-			
LED	0.34	0.08	0.42	0.22	0.51	0.12	-		
LS	0.14	0.04	0.43	0.48	0.41	0.61	0.33	-	
ST	0.13	0.19	0.09	-0.02	0.19	-0.22	0.12	-0.11	-

Table 14. Variance Inflation Factor (VIF) and weights for instrument development process.

Construct	Item	Outer VIF	Inner VIF	Weight	Outer loading
Complexity in process (CP)	CP1	1.06	1.17	0.17	0.39
	CP2	1.06		0.95***	0.99***
Sophistication of technology (ST)	ST1	1.12	1.12	1.05***	0.97***
	ST2	1.12		-0.26	0.09
Challenges in project management (CPM)	CPM1	1.46	1.48	0.31**	0.75***
	CPM2	1.44		0.48***	0.79***
	CPM3	1.44		0.15	0.65***
	CPM4	1.27		0.42***	0.71***
Lack of standards (LS)	LS1	1.96	2.10	0.04	0.71***
	LS2	2.53		0.58*	0.95***
	LS3	2.69		0.46	0.92***
Changes in external state (CES)	CES1	1.13	1.29	-0.11	0.23
	CES2	1.24		0.11	0.51**
	CES3	1.13		0.11	0.39*
	CES4	1.33		0.94***	0.98***
Different frames of reference (DFR)	DFR1	1.00	1.41	0.41**	0.45**
	DFR2	1.00		0.89***	0.91***
Failure of evaluation methods (FEM)	FEM1	2.73	1.75	0.73	0.98***
	FEM2	2.73		0.32	0.90***
Lack of evaluation data (LED)	LED1	2.10	1.38	0.02	0.47***
	LED2	1.26		0.97***	0.99***
	LED3	2.05		0.03	0.45***
Bootstrapping results (n = 5000)					
*Significant at the 0.10 level (two-tailed)					
**Significant at the 0.05 level (two-tailed)					
***Significant at the 0.01 level (two-tailed)					

Furthermore, we utilized the importance-performance analysis by using a feature of SmartPLS 3 (version 3.16) (Ringle et al. 2014). The matrix provides the impact of each distinct cause of equivocal situation on the equivocal situation construct (ES) and is a priority map for organizations to provide extra consideration and concentration to different areas of project management. The matrix plots potential causes which warrant improvement. Figure 12 visualizes the relative performance and importance among causes of equivocal situations. To lessen the level of an equivocal situation, consideration should be given to aspects of high importance and performance. In Figure 12, the X axis represents the total effect or the importance of the causes based on the

impact of the causes affecting the equivocal situation. The Y axis represents the performance of the causes. To illustrate this, four clusters of equivocal situation causes can be made from the figures based on the similarity of their importance. The CPM (first cluster), which lies on the left side of the matrix, is portrayed as being the most important cause. The first, the second, the third, and the fourth cluster have a distinct impact on the occurrence of an equivocal situation. Extra consideration should therefore be given to CPM. In our case, a high performance score (Y axis) means more room for further improvement. Within a cluster, attention should also be given to causes with a high performance (Y axis). DFR, ST, and CP are the causes which could be improved further by the organization to lessen the amount of equivocality in the project evaluation. For instance, a problematic situation due to Different frames of reference (DFR) may be improved by ensuring the capability of each decision-maker to collaborate and proceed with effective evaluation (DFR2).

Figure 12. Importance-performance matrix for the initial formative model (SmartPLS 3 output)

5.4 Discussion and Limitation

Despite the importance of equivocality in affecting the continuation of IS/IT projects, antecedents of equivocal situations are not well established. In this study, we describe the development and assessment of an instrument to define equivocal situation and eight causes of equivocal situations in the context of IS/IT project evaluation. The stages of the instrument-development process provide a meaningful instrument that has been assessed thoroughly. In the exploratory domain, we examine extant literature to provide insights into the notion of equivocality and its causes. During the instrument development, we employ a qualitative method to corroborate and improve the developed constructs and items. To further enhance the instrument, we utilize Q-sorting exercises. After a pilot test, we apply the instrument by acquiring responses from knowledgeable practitioners in IS/IT project management practice.

This study contributes to current research by means of the development and validation of instruments to measure equivocal situation and its causes in IS/IT project evaluation. This study offers a conceivable description and explanation of equivocal situation and the causes of such a situation via emerging issues associated with: the complexity of the process used to develop the IS/IT, the sophistication of the technology being developed, the challenges met when managing IS/IT projects, the dearth of criteria used to evaluate IS/IT projects, the dynamics of the environments surrounding the projects, the divergence of the decision-makers' frames of reference, the failure of evaluation methods, and the lack of evaluation data to support decision-making. Moreover, this study is of practical relevance for practitioners: the availability of a usable instrument to gauge their IS/IT projects execution and evaluation, and to forestall the occurrence of an equivocal situation. The gained insight from this study does not mean that extra devotion should be given only to the causes which have a high impact on the occurrence of equivocal situation *per se*. The knowledge of how the causes emerge from different issues of project management and are then translated into problematic situations (i.e., confusion and dilemma) should be looked at and worked on in detail. It will make practitioners more aware and will stimulate them to be critical about their current practice.

Nevertheless, this study entails some limitations. First, the composition of the constructs and items derived from the literature review and qualitative studies may not

be exhaustive. Likewise, the constructs do not contain equivalent numbers of items due to the way we identify and derive the problems of equivocality. To a certain extent, this may influence certain causes with large numbers of items, as the impact on an equivocal situation may be greater. Second, the way we model equivocal situation and its causes may not be definitive and the way we specify the constructs is debatable. One should consider and compare other possibilities to model the relations. Third, we do not consider the heterogeneity of our sample. This may have limited the accuracy of the PLS computation and the result.

5.5 Conclusion and Further Research

The purpose of this study is to develop and assess an instrument to measure equivocal situation and its causes. The study contributes to extant literature on IS/IT project management literature by establishing the concept of equivocality in IS/IT project evaluation, identifying the causes, as well as developing an instrument to measure them. Further examination of equivocal situation and its causes can be warranted by considering alternative or competing ways to model the equivocal situation and its causes in the context of IS/IT project evaluation. This includes the possibility to improve the current model by constructing a hierarchical component model (HCM) or higher-order constructs. For instance, the formative-formative type IV model could be developed. According to Becker et al. (2012), *“the formative-formative type model can also be useful to structure a complex formative construct with many indicators into several sub-constructs”*. This is also beneficial to reduce the number of competing causes that connect to the equivocal situation construct by arranging the causes into theoretically-supported categories or groups (Hair et al. 2014). Analyzing the heterogeneous groups within IS/IT projects (e.g., different types of information systems or technology) and extending the nomological network of other constructs associated with equivocal situation (e.g., evaluation decision) can be warranted as well. Furthermore, as around 41 per cent of the respondents were willing to discuss their answers to the questionnaire further, it merits post hoc analyses of relationships among the constructs and on how the respondents coped with equivocal situations.

Chapter 6. To Continue or Discontinue the Project, That is the Question¹²

¹² This chapter based on a paper submitted to International Conference of Information Systems (ICIS) 2015.

Abstract

Information systems and technology (IS/IT) projects are perceived as ventures that are prone to failure. An evaluation as part of IS/IT governance and control is highly important for stakeholders, to lessen the risk and the failure of such projects. However, decision-makers often encounter difficulties when evaluating and making decisions regarding the continuation of their projects. This study examines equivocal situations and the antecedents of dilemmas in project evaluations. A theoretically grounded research model postulates the influence of Content, Context, and Process of evaluation on the prevailing equivocal situations. The model, which is tested using PLS analysis, shows the impacts of the Challenges of project management, the Lack of standards, and the Sophistication of Technology on the extent of equivocal situations. This study is based on a survey of 111 projects and offers early empirical evidence attesting to the importance of well-defined project charters and senior management control in IS/IT governance.

6.1 Introduction

With the current pace of competition and technology, organizations become reliant on the success of their IS/IT investments and portfolios. To govern and instigate the investments, IS/IT program management is carried out, so that the implementation can account for the organizational strategy (Lycett et al. 2004). IS/IT portfolios typically constitute several projects such that their implementation are easily susceptible to failure (Bannerman 2008; Parent and Reich 2009). IS/IT projects are infamous for their long duration, their requisite for large resources, and their complexity (Kipp et al. 2008). It is found that the occurrence of rare and unpredictable events caused by a lack of experience during the project execution are often destructive (Buhl 2012).

Pan et al. (2006) suggest the practice of evaluation can be used to govern the risk associated with the projects. Employing effective evaluations may contribute to higher project success rate. Farbey et al. (1999) described that an evaluation of information systems and information technology (IS/IT) is “*a process, or group of parallel processes, which take place at different points in time or continuously, for searching and for making explicit, quantitatively or qualitatively, all the impacts of an IT project and the programme and strategy of which it is a part*” (p. 190). The evaluation is conducted to: (1) provide an indication of the projects’ progress and likely success; (2) appraise the worthiness of continuing the projects; and, (3) allow intervention of projects which deviate from their plan (Seddon et al. 2002; Snow and Keil 2002a; Thompson et al. 2007). An evaluation, as part of decision-making process, is indispensable when justifying a choice of action (Gunasekaran et al. 2006; Pan et al. 2006; Seddon et al. 2002). The projects may proceed with several possible courses of action. This may include decisions ranging from continuing the projects as planned to abandoning the projects. Yet, “*one of the most difficult management issues that can arise in connection with IT projects is deciding whether to abandon or continue a project that is in trouble*”, as commented by Keil (1995) (p. 422).

Despite the importance of evaluations when making purposeful decisions, organizations are suspected of having difficulty conducting evaluations of IS/IT projects in practice as it is problematic and challenging to discern the exact progress of the projects (Abdel-Hamid et al. 1993; Mähring and Keil 2008). Information associated with the projects may suffer from multiple interpretations and a lack of clarity; hence, it may arouse disagreement among decision-makers (Irani 2002; Smithson and Hirschheim

1998b). Decision-makers may interpret the projects' worthiness from unclear indications and get trapped in dilemmatic situations due to confusion and a lack of understanding of the project condition. The event and the process of evaluation to ascertain the state of the project is a reference point when deciding the continuation of IS/IT projects. (Snow and Keil 2002a; Thompson et al. 2007). Decisions hence often rely upon personal experience and judgments (Bannister and Remenyi 2000) frequently made in so-called equivocal situations. Continuation decisions, especially the strategic one, are considered as crucial decisions and are likely to suffer from different interpretations of the underlying problems and exhibit characteristics of ambiguity, uncertainty, and conflict (Brown 2005). A further examination of the relation between the practice of evaluation would be invaluable and the occurrence of equivocal situations since continuation decisions are based on project evaluations.

Discussions on how equivocal situations emerge when evaluating the projects' next course of action are scant. Research examining antecedents of equivocal situations is still limited, especially in IS/IT project evaluations. Prior studies were particularly focused on examining the project's appraisal methods and pointed to the drawbacks of traditional capital budgeting techniques, stating they are the antecedents of equivocal situations (Keil and Flatto 1999; Taudes et al. 2000; Tiwana et al. 2006; Tiwana et al. 2007). The antecedents of equivocality and thus their importance in project evaluations are not well recognized despite the significance of equivocality in affecting continuation decisions as supported by recent studies (Sleesman et al. 2012).

To address this gap, we utilize a mixed-methods research design that combines qualitative and quantitative methods to glean insights into equivocal situations and the immediate antecedents of equivocality in project evaluations. This option is mainly for developmental purposes, i.e., qualitative findings are used to develop the research model for further quantitative analysis (Venkatesh et al. 2013). Furthermore, to compensate for any limitations inherent in the qualitative part, quantitative evidence will provide powerful insights and generalizability of the overall results. Specifically, we endeavor to address the following research question:

What are the salient antecedents driving equivocal situations in IS/IT project evaluation and what are the insights that decision-makers need to take into account before embarking on such evaluations?

This study strives to close the gap and answer the aforementioned research questions with a theoretically grounded research model built upon exploratory qualitative studies: it will reveal the antecedents of equivocal situations and also offer early evidence of equivocal situations in project evaluations, based on a survey of 111 IS/IT projects.

6.2 Theoretical Foundation

Bowen (1987) introduced the term ‘equivocal information’ as the information for which multiple (positive or negative) interpretations can be constructed. Based on his Decision Dilemma theory, equivocal information may lead to escalation (Bowen 1987). In equivocal situations, decisions to escalate are likely to prevail as commitments of additional resources are believed to be economically prudent. Escalations occur when decision-makers believe that the information is inadequate to suggest whether additional investments will (not) fulfill expectations. An endeavor should be abandoned when the information is unequivocally negative whereby the effect of the endeavor would be so detrimental that even additional resources would not bring success (Bowen 1987). Studies in the field of experimental psychology reinforce Bowen’s conjecture on equivocality, substantiating the effects of equivocality on escalation and delayed abandonment (Bragger et al. 1998; Bragger et al. 2003). Sleesman et al. (2012) find the significance of the ‘information set’ construct, consisting of information acquisition and decision uncertainty, drawn from Bowen’s view, as the determinant of escalation. Specifically, information acquisition is found to be one of the strongest inhibitors that will reduce the likelihood of escalation based on their meta-analysis.

According to Farbey et al. (1992), evaluations are beneficial since they allow organizations to control projects and to compare the merit and worth of different projects competing for limited resources. Once the projects or a portfolio of projects are justified, evaluations are needed to assure smooth realization of the resources devoted to them. Through the use of appraisal methods and techniques, evaluations allow decision-makers to benchmark and define costs, benefits, risks, as well as the implications of the IS/IT projects (Irani et al. 2005). Bowen distinguishes between unequivocal and equivocal situations as follow: “..situations where the decision maker(s) have or are able to construct and commit themselves to credible criteria which can be fully and satisfactorily compared

to available data, versus situations where the decision maker(s) do not have or are unable to create such criteria or do not have sufficient data to fully compare against the standards.” (Bowen 1987) (p. 61). Putting Bowen’s premise into an IS/IT evaluation context, the extent to which equivocality is hampering decision-makings may be determined by how evaluations are employed.

Several IS/IT evaluation studies have indicated comparable challenges to the equivocal situations (Irani 2002; Smithson and Hirschheim 1998a) described by Bowen (1987). Inclusion of multiple criteria may enhance the evaluation; yet, it can be problematic due to difficulties in identifying and measuring the wide-ranging criteria (Farbey et al. 1995; Irani et al. 2006). A mixture of techniques or a modified/hybrid technique is required for certain cases; yet, these evaluation methods demand extra knowledge and expertise from the decision-makers. An evaluation is also highly dependent on continuous data retrieval from the on-going projects; however, the process of collecting and reproducing the data in appropriate forms for decision-makers is challenging, time consuming, and costly (Brown 2005). A dearth of such data can lessen the support of evidence-based evaluations and may abate confidence in decision-making. Moreover, particular IS/IT projects attempt to implement systems and technologies which are novel, more complex, and more risky and therefore often subject to business judgments. The strategic value of these systems can significantly influence the conduct of evaluation, in terms of its complexity and difficulty (Farbey et al. 1995; Fitzgerald 1998). As a result, personal experiences and judgments are often used to justify the continuation of IS/IT projects due to the prevailing equivocal situations in project evaluations (Bannister and Remenyi 2000). The antecedents of decision dilemmas described by Bowen (1987) may be rooted in the challenges encountered when embarking on IS/IT project evaluations.

Early attempts to investigate the antecedents of equivocal situations within IS/IT fields, for instance, evaluation using the common capital budgeting techniques, propose it may systematically underestimate the true value of IS/IT projects (Keil and Flatto 1999). The real option theory was adapted as an alternative viewpoint for IS/IT investment and suggested the traditional cost-benefit project measurement should be balanced (Tiwana et al. 2006). Hence, equivocality in project evaluations is linked to the drawbacks of traditional capital budgeting techniques. Difficult quantification of benefits

associated with the projects has made these techniques sometimes inadequate and are likely to create unbalanced evaluations.

6.3 Research Design

We designed two study phases. In the first phase, we utilized qualitative studies consisting of three main steps: literature review, interviews with experts, and project case studies. The literature review was conducted to (1) examine the concept of equivocality and identify typical characteristics of equivocal situations; (2) identify the issues that lead to equivocal situations; and, (3) develop initial categories of the antecedents of equivocal situations. The qualitative part was done mainly through interviews and discussions with experts and knowledgeable IS/IT-professionals in practice. Seven interviews with experts were examined and ten interviews were analyzed within four project case studies.

As depicted in Figure 13, the literature review and qualitative field studies were performed independently; however, the three steps were connected to each other as an iterative process between qualitative data collection and analysis (Eisenhardt 1989). We developed an initial framework that pulls together the characteristics of equivocal situations and the antecedents using evaluation frames based on IS/IT evaluation literature. The initial framework was used to guide the field studies and was refined as well during the iterative process. The interviews were recorded and transcribed. Identified issues were gathered in a pool and analyzed qualitatively in order to improve and align them with prior identified issues from the literature review. Throughout these steps the constructs were improved and the measurement model was developed. Additional literature was searched and examined for similar constructs. As a result, the qualitative data, combined with the insights from the literature allowed us to develop our theoretical model and hypotheses between the categories of antecedents and the equivocal situations. Following the qualitative part, we employed Q-sorting exercises and pilot testing. Then, we sampled 111 IS/IT projects. We assessed the measurement and the structural model using Partial Least Square (PLS) analysis. Finally, we tested the hypothesized relationships and examined the results. Details of the two phases are described further in the next sections.

Figure 13. Research flow and derivables

6.4 Exploration and Model Development

In this section we describe the first phase of our study starting with the literature review followed by qualitative field studies comprise extensive interviews with experts and project case studies (cf. Chapter 2, 3, and 4). It is not easy to attain general consensus from the selected publications on the definition of equivocality. Most of them view equivocality to be analogous with ambiguity. For instance, Daft et al. (1987) write “equivocality means ambiguity, the existence of multiple and conflicting interpretations about an organizational situation.” Zack (2007) attempts to distinguish four related problems of ‘knowing’, these are equivocality, ambiguity, uncertainty, and complexity and describes equivocality as “having several competing or contradictory conceptual frameworks” and ambiguity as “not having a conceptual framework for interpreting information.” Additionally,

Malhotra (2001) argues that the common denominator of both terms is knowledge, as equivocality and ambiguity are both involved in managing and processing knowledge. We opt to use equivocality and ambiguity in the same manner as Bowen (1987) who states that an equivocal situation occurs “*in cognitively unstructured situations, where individuals have either insufficient or no knowledge of ‘what leads to what’*,” which is comparable to Zack’s stance of ambiguity.

Moreover, Zack (2007) describes uncertainty as “*not having enough information*”. In a competing argument, Frishammar et al. (2011) argue that uncertainty and equivocality are, to some extent, correlated and are similar as information is the vital key to reduce both problems; however, the information-processing activities are different. Uncertainty demands additional new information while equivocality necessitates the exchange of subjective information (e.g., views and judgements) among decision-makers (Frishammar et al. 2011). In his paper, Zack (2007) also points out the term complexity has “*more information than one can easily process*.” Later in our study, we postulate the potential influence of complexity to the degree of equivocal situations occurring in project evaluations, termed as Complexity in process. This is grounded in prior studies, based on the literature review (e.g., Koufteros et al. (2005) remark that the presence of complexity in products and processes may induce confusion and ambiguity of product development) and our qualitative field studies.

An equivocal situation in IS/IT project evaluation is defined as the state experienced by decision-makers or evaluators due to lack of clarity and confusion when deciding whether to continue a project. This occurs when lack of knowledge or diverse knowledge exists regarding information surrounding the project, especially its past performance and future attainment. The situation is typically evident when multiple interpretations, conveyed meanings or perceptions toward the project, exist. Other indications of equivocal situations include the indeterminacy of analyzed data to support decision-making, the demand for ‘richer’ or different types of information, and the attainment of consensus by decision-makers when exchanging views and judgments through social interaction to settle disagreements.

We further underlined the characteristics of equivocal situations that can serve as indicators based on the literature review (an example of an excerpt is provided in brackets as the foundation for each indicator): (1) the existence of different

interpretations toward the projects' status – ES1 (“*An equivocal situation refers to the extent that multiple and conflicting meanings exist among project participants.*”); (2) the lack of clarity of the projects' condition – ES2 (“*Equivocality is defined as absence of clarity, or ambiguity, due to multiple interpretations of the same information.*”); and, (3) the indeterminacy of analyzed data to evaluate the projects – ES3 (“*Problems of ambiguity, subjectivity, and different frames of reference cannot be resolved simply by analyzing objective data.*”). Next, we adapted the items from Carson et al. (2012), Watts Sussman and Guinan (1999), Daft and Macintosh (1981), and Lim and Benbasat (2000) to align our items with the extant studies.

We examined IS/IT evaluation literature for evaluation constituents and their interactions to develop the theoretical model of equivocal situations, using content, context, and process (CCP) framework (Serafeimidis and Smithson 2000; Stockdale and Standing 2006). This idea was introduced by Symons (1991) who posited that conducting effective evaluation would require an understanding and a management of linkage between elements of content, context, and process of evaluation.

By reflecting on the CCP framework, Stockdale and Standing (2006) stated that “*evaluation is guided by addressing the questions: why is the evaluation being done? What is being evaluated? Who affects the evaluation? When is the evaluation taking place? And how is the evaluation to be carried out?*” (p. 1090). Additionally, Goldkuhl and Lagsten (2012), through their conceptual practice model of evaluation (CPME), describe that “*evaluation is conceived as a purposeful study of some evaluation object (evaluant) comprising 1) the generation of data of and from this object, 2) the selection and formulation of appropriate criteria to be used as yardsticks and 3) the matching of data and criteria in order to formulate evaluative statements and conclusions about the evaluation object*” (p. 6).

The above give a broad view of the typical frameworks employed by organizations for their decision-making. These frameworks suggest evaluation is a practice and a process to acquire additional knowledge related to an object that consists of several elements, for instance the criteria, the people, and the procedure, within the ‘content’, the ‘context’, and the ‘process’ of evaluation (Goldkuhl and Lagsten 2012). The broad view of these frameworks provides useful insights into the constituents of evaluation and the guidelines to establish key issues during evaluations (Stockdale and Standing 2006).

In the first phase, the categories of equivocal situation antecedents were developed through an iterative process between qualitative data collection and analysis. Codes and categories were developed, extended, and merged to improve the scope of the categories of the antecedents that serve as constructs in the quantitative examination (the second phase). The breadth of the constructs was redefined iteratively during this process. This resulted in a set of eight categories of antecedents of equivocal situations. Additional literature was also searched and reviewed for similar constructs and measurements to assist in the operationalization of the constructs. The terms, the characteristics, the antecedents, and the elements indicating equivocal situations reflect both the literature review and the results of the qualitative studies. It should be stressed that the development of the constructs and their measurements are limited to the issues that were identified during the qualitative studies and supported by the literature review.

We mapped the constructed categories of equivocal situations antecedents into the evaluation frame. Figure 14 depicts the connection between the evaluation frames and their corresponding categories of antecedents that potentially lead to equivocal situations. Through this perspective, we constructed a model that can be used to differentiate which evaluation constituents are substantially affected by the antecedents. Figure 15 presents the proposed research model. The model can reveal which evaluation constituent has the highest association with the occurrence of equivocal situations as well as the salient antecedents.

Content		Context		Process	
Evaluation frame	Identified cause	Evaluation frame	Identified cause	Evaluation frame	Identified cause
• Object of evaluation	• Complexity in process • Sophistication of technology • Challenges in project management	• Influences from external environment	• Changes in external state	• Utilization of appraisal techniques and tools	• Failure of evaluation methods
• Establishment of evaluation criteria	• Lack of standards	• Involvement of people as evaluators/decision-makers	• Different frames of reference	• Making sense of the data	• Lack of evaluation data

Figure 14. Mapping the causes of equivocal situations within the evaluation frame of CCP

Figure 15. Theoretical model of equivocal situations

We modeled the Equivocal Situations construct as a dependent variable which is affected by the antecedents arranged in the Content, Context, and Process of evaluation. The Equivocal Situations (ES) construct refers to the extent to which evaluation of the project is hampered by equivocality. The frames of evaluation (Content, Context, and Process) are conceived as second-order constructs comprised of eight first-order constructs, i.e., the antecedent categories. Then, each identified issue of equivocality serves as a measured variable. Our prime objective was to substantiate the

applicability of the theoretical model in predicting the occurrence of equivocal situations in IS/IT project evaluations given the extent of various antecedents within the Content, Context, and Process of evaluation. The hypotheses development is described in the following subsections.

6.4.1 Content of Evaluation

On employing evaluation, a group of people or stakeholders who act as decision-makers or evaluators will define the object of the evaluation (i.e., an IS/IT project) and will use particular criteria to assess the object. This is termed as the content of evaluation or the constituents within the ‘what’ of evaluation. The criteria could range from efficiency, effectiveness, to a more strategic consideration (Smithson and Hirschheim 1998a). We identified four problems related to equivocality within the content of evaluation. The first, the second, and the third problems are connected to IS/IT projects as the object of evaluation. Firstly, substantial intricacy in IS/IT developments could make it hard to estimate the precise status or progress of the projects. Secondly, the sophistication of the technologies or the systems being implemented could hinder evaluators in their ascertainment of the projects, for instance due to the lack of experiences or benchmarks. Thirdly, poorly managed projects could cause considerable difficulties in evaluations, for instance, due to the lack of proper reports from or monitoring by management teams. Moreover, the fourth problem is related to the use of particular evaluation criteria, for instance if there are neither clear evaluation criteria nor any agreements on such criteria among decision-makers. The constructed categories of equivocal situation antecedents within the Content of evaluation are:

1. *Complexity in process* (CP), defined as the extent to which the process of developing the intended IS/IT involves substantial intricacy. Most of the participants in the qualitative studies referred positively to the importance of this category during the interviews. We highlight several issues within this category; such as the large number of stakeholders involved in the project and the numerous sub-projects conducted. The latter implies a substantial inter-connection among projects and information systems as well. For instance, one of the project managers admitted “[The situation] actually [occurred because] the [number] of stakeholders is too big to organize in that certain time limit.” Aligning with extant studies, we opted to use items which

indicate multiple stakeholders' involvement (CP1) and extensive information systems integration (CP2) (Ahmad et al. 2013; Watts Sussman and Guinan 1999; Weidong and Lee 2005). We hence propose that:

Proposition 4: Complexity in the process has a significant positive contribution to the Content of evaluation.

2. *Sophistication of technology* (ST), defined as the extent to which the design of IS/IT products or solutions is considered innovative or advanced. Most of the qualitative studies' participants referred to this category during the interviews. They felt that the category had an effect on their situations; however they thought the category would be have been of less importance. We highlight some issues within this category such as involvement of novel concepts within the information systems and not well-proven information systems. As underlined by one of the project managers "*..no other project [is] comparable [to] our project in [the] whole [name of a region] [in terms of a theme of information systems].*" In line with extant studies, we opted to use items which indicate the involvement of novelty (SP1) and immaturity of technology (SP2) within the projects (Han and Huang 2007; Martinsuo and Poskela 2011; Wallace et al. 2004b) We hence propose that:

Proposition 5: Sophistication of technology has a significant positive contribution to the Content of evaluation.

3. *Challenges in project management* (CPM), referring to the extent to which the IS/IT project encounters substantial management challenges. Most of the participants in the qualitative studies pointed to this category as the antecedent of the situations they had encountered. Almost all of the participants expressed agreement with and the importance of this category. We highlight some issues within this category; such as undefined project charters and lack of senior management control. For instance, one of the participants illustrated "*We [didn't have] very specific goals; such specific goals were not set.*" "*..along the way [we saw] how it evolved, so [they] weren't very smart goals to start with.*" In another part "*I made several attempts [at] the [project] to make [the] goals more specific, there are [a number of] reports about it, but it [did] not [really become] specific, no, it was still a bit [of a] vague project.*" According to extant studies, we opted to use items which indicate the project planning (CPM1) and monitoring (CPM2),

communication among the project team (CPM3), and the clarity of the project charter (CPM4) (Keil et al. 2003; Schultz et al. 2013). We hence propose that:

Proposition 6: Challenges in project management has a significant positive contribution to the Content of evaluation.

4. *Lack of standards* (LS), defined as the extent to which evaluators/decision-makers utilize evaluation criteria to ascertain the project value. Not all of the participants supported this category, both in terms of agreement and importance. However, participants in the interviews with experts felt, to a certain extent, the presence of equivocal situations when evaluating the risks and benefits compared to evaluating costs. For instance, one of the project managers emphasized “*..the outcome of the project was not [easy to measure] [in terms of] the right outcome, because it was quite [an] innovative project. When you [are] working on [a name of information systems theme], you cannot make a simple decision based on money, because your return of investment in this certain moment is quite unclear; that is the problem with innovation, based on which outcome you [will] make your decision to [either] stop the project or to go along with it?*” Following Bowen’s (1987) argument concerning the Lack of standards in equivocal situations and in line with extant studies, we opted to use items which indicate the clarity of decision criteria (LS1), the credibility of the criteria (LS2), and the agreement of such criteria (LS3) (Hammedi et al. 2013; Martinsuo and Poskela 2011; Schultz et al. 2013). We hence propose that:

Proposition 7: Lack of standards has a significant positive contribution to the Content of evaluation.

Thus, we hypothesize that, in the context of project evaluations, H1: the antecedents within the Content of evaluation are positively associated with the occurrence of an Equivocal situation.

6.4.2 Context of Evaluation

The CCP framework also suggests that evaluations will be influenced by the contextual setting, such as the projects’ external environment and the people who handled the evaluations. This is termed as the context of evaluation. IS/IT projects are sometimes conducted to fulfil diverse objectives; the context within the evaluation frame captures the external environment dynamics and the various decision-makers’ influences toward

the projects, which could hinder insightful evaluations. We identified two problems related to equivocal situations within the context of evaluation. Firstly, substantial changes or environmental dynamics surrounding the projects could confound the evaluations and the subsequent decisions. Secondly, different perspectives of people as evaluators may further complicate the evaluations. The constructed categories of equivocal situations antecedents within the Context of evaluation are:

1. *Changes in external state* (CES), referring to the extent to which the project is affected by organizational environmental dynamics. The qualitative studies' participants supported this category a little, as the antecedent of problematic situations they had experienced. We highlight some issues within this category; such as corporate politics and substantial external changes. For instance, one of the corporate managers expressed “*...there is a lot of political pressure also in the project [which] makes people quite nervous.*” Aligning with extant studies, we opted to use items which indicate the external changes within the law or regulations (CES1), organizational structure (CES2), and resources allocation (CES4) as well as political dynamics during the project (CES3) (Carson et al. 2012; Han and Huang 2007; Wallace et al. 2004a; Wallace et al. 2004b). We hence propose that:

Proposition 8: Changes in external state has a significant positive contribution to the Context of evaluation.

2. *Different frames of reference* (DFR), referring to the extent to which evaluators/decision-makers have diverse viewpoints when evaluating the project. Many of the qualitative studies' participants implied this category is the antecedent of problematic situations. Yet, they did not support this category so much as one of the antecedents in the discussion, both in terms of agreement and importance. We highlight some issues within this category; such as difference in background, skill and ability. For instance, one of the project boards stressed “*The project was a big project with a lot of stakeholders from different companies with different approaches and different views.*” In line with extant studies, we opted to use items which indicate the background of the decision-makers (DFR2) and the decision-makers' complementary skill or ability when conducting an evaluation (DFR2) (Lee and Xia 2010; Van Doorn et al. 2013). We hence propose that:

Proposition 9: Different frames of reference has a significant positive contribution to the Context of evaluation.

Thus, we hypothesize that, in the context of project evaluations, H2: the antecedents within the Context of evaluation are positively associated with the occurrence of an Equivocal situation.

6.4.3 Process of Evaluation

Furthermore, the term 'process of evaluation' refers to the constituents within the 'how' of evaluation. The process represents the utilization of techniques and tools and the analysis of the extracted data in order to formulate verdicts regarding the evaluation object. The methods, together with the data, play an important role in suggesting the next course of action. The identified problems of equivocality within this frame are the failure of evaluation methods and problems with the evaluation data. For instance, the absence of evaluation procedures or adequate data to support decision-making would increase the likelihood of equivocal situations emerging. The constructed categories of equivocal situations antecedents within the Process of evaluation are:

1. *Failure of evaluation methods* (FEM), referring to the extent to which evaluators/decision-makers apply techniques or tools to evaluate the projects. The participants did not support this category so much in general, both in terms of agreement and importance. We found minimum use of formal evaluation methods. For instance, one of the project managers admitted “...so I tried to balance it, actually it's a combination of the impact of the problem and the size of the problem, it's not an official tool but that's what I did.” Another participant stated “Yeah, so we have ways to assess the planning, ways to assess, uh, function points, so this influences [the situation we had] and [the methods are] also quite important, of course the method how you gain your information determines, uh, its quantifiability, its robustness.” While we could not reveal the issues fully within this category, we suspect that the absence of evaluation methods can induce an equivocal situation. We decided to maintain this antecedent since the category was revealed from the thematic inductive method in our previous literature review. Aligning with extant studies, we opted to use items which indicate the application of a predefined procedure to evaluate the projects (FEM1) and the

application of specific evaluation techniques or tools (FEM2) (Martinsuo and Poskela 2011). We hence propose that:

P10: The failure of an evaluation method has a significant positive contribution to the Process of evaluation.

2. *Lack of evaluation data* (LED) referring to the extent to which evaluators/decision-makers use data surrounding the project to support decision-making. The qualitative studies' participants supported this category to a degree as the antecedent of problematic situations they had encountered. We highlight some issues within this category; such as availability, sufficiency, and the provision of data/information. For instance one of the corporate managers stressed "*..there was an evaluation moment but there [were] really very [few] materials available to make the, uhm, that you could use to make a decision.*" Further to extant studies, we opted to use items which indicate the accuracy (LED1), the availability (LED2), and the level of detail of the data (LED3) when evaluating the projects (Gattiker and Goodhue 2005; Karimi et al. 2004). We hence propose that:

P11: Lack of evaluation data has a significant positive contribution to the Process of evaluation.

Thus, we hypothesize that, in the context of project evaluations, H3: the antecedents within the Process of evaluation are positively associated with the occurrence of an Equivocal situation.

It is important to highlight that the above description of our hypotheses development is complemented by an illustration of constructs-measurement development and the references to operationalize the constructs. The provided quotations in each category of equivocal situation antecedent are by no means exhaustive but intended to provide exemplars of the development process.

6.5 Model Examination

We constructed the measurement items by adopting the scales that were aligned with our qualitative findings and relevant within our constructs' definitions. The existing scales were reworded to ensure suitability with the research domain. We utilized two rounds of Q-sorting exercises to assess validity of our constructs by following the procedure set by Moore and Benbasat (1991). These steps were chosen to derive proper measurement items in terms of their reliabilities and validities for each antecedent category (cf. Chapter 5). An average 'hit ratio' of 86 per cent, an average raw agreement of 85 per cent, and an average Kappa of 83 per cent were attained after the second round. A Kappa value of 0.65 or higher is considered as an acceptable agreement according to Moore and Benbasat (1991). The results of these sorting exercises suggest the items tap adequately into the intended constructs. This also ensures substantive validity to continue to the next pilot test.

We developed a survey questionnaire based on the results of the Q-sorting exercises. The research team examined the initial draft of the questionnaire and made several modifications to make sure that the content was clear and easy to understand. A pilot study was performed to obtain feedback and initial analysis of the measurements. No substantial changes were made during this pilot. Moreover, the initial analysis indicated good measurement quality. The aforementioned processes, i.e., the qualitative part and the instrument development, provide substantial content validity to the constructs and the instrumentation before testing them empirically. The final questionnaire was distributed as a web link and answered using an online tool. We approached potential participants by (1) sending an invitation to personal contacts; (2) sending the invitation to several relevant LinkedIn groups; and, (3) requesting IS/IT professional organizations to partake in our survey. Two IS/IT professional organizations agreed to post invitations on a website and sent invitations via newsletters/emails. Since we distributed the survey mainly over the internet to unconfined groups, the actual response rate is hard to calculate. Based on a report from the survey's web link, around 252 people accessed the survey and 111 participants (44%) filled in the survey fully. Calculating Cohen's power of regression analysis at $\alpha=0.05$ with a medium effect size ($f^2=0.15$) and a power level of 0.8, a sample of at least 84 was needed (Hair et al. 2014).

The survey asked participants to recall a recent review or evaluation of a challenging IS/IT project they had been involved in and to keep this one project in mind throughout the questionnaire. We assessed the extent of the equivocal situation and each of the antecedents using the items discussed in the qualitative part. We employed the 7-point Likert scale that ranges from (1) Not at all and (7) Very great extent, to each of the measurements.

The profiles of the survey respondents are described as follows (Figure 16): mostly senior IS/IT managers or CIO (23%), project managers (21%), IS/IT managers (19%), and the rest includes non-senior or non- IS/IT managers (e.g., marketing, finance) and other roles such as consultants, auditors, etc. The top three sectors the respondents work for are: banking (financial) (16%), IT services (14%), and Government (13%). More than half of the respondents (52%) work in organizations which are considered larger than average. The respondents mostly have more than 10 years of experience in their industries (58%).

The projects profiles are as follows: the top two primary purposes of the projects are business transformation (20%) and strategic system (19%). The project types consist of packaged software implementation (35%), in-house new development (30%), and enhancement of existing software/systems (15%) (Figure 17). 69% of the projects are considered larger and 70% are of longer duration than other IS/IT projects undertaken by the organizations (Figure 18).

Concerning the decision of evaluation, 18% of the projects are suffering total and substantial abandonment. 51% of the projects are categorized as escalated, and another 26 % of the projects are continuing as planned. Around 40% of the projects are not over budget, 23% are not behind schedule, and 32% are not lacking in requirements or required specifications. Most of the projects are, to a certain extent, suffering from over budget (60%), behind schedule (77%), and lack expected requirements or specifications (68%). Figure 19 depicts condition of the chosen project at the time of evaluation.

Figure 16. Profile of respondent

Primary Purpose of Project

Project Types

Figure 17. Profile of project (A)

Figure 18. Profile of project (B)

Figure 19. Condition of the chosen projects at the time of evaluation

Considering the nature of our study, we utilized PLS analysis using SmartPLS 2.0 (M3) (Ringle et al. 2005). The PLS technique is well suited for theory building and prediction as well as handling mixed reflective and formative measures (Ringle et al. 2012). PLS analysis was used to test the measurement model and to analyze the direction and strength of each relationship. We modeled the indicators of equivocal situations as reflective measures. Regarding the antecedents of equivocal situations, we modeled the indicators as formative measures. This was decided for the following reasons: (1) the antecedents of equivocal situations are grounded using a thematic inductive method by means of a literature review followed by exploratory qualitative studies. The employed thematic method results in constructs that are comprised of varied observable elements; (2) the indicators are, to a reasonable extent, expected to cause variance in the latent constructs since the antecedents of equivocal situations are conceived to be composite constructs that give, when bundled, sets of different detailed facets of particular antecedents (Cenfetelli and Bassellier 2009); and, (3) it is beneficial to use formative constructs since the contribution of individual indicators can be further assessed by evaluating their path weights (Esposito Vinzi 2010). Furthermore, we expected that the indicators of the antecedents of equivocal situations will have less covariation within the same latent constructs.

As to the reflective construct, the suggested threshold values of the indicator loadings, the average variance extracted (AVE), composite reliability, and Cronbach's alpha are 0.70, 0.50, 0.70, and 0.70, respectively (Hair et al. 2010; Hair et al. 2011). All the constructs of the equivocal situation (ES) values are higher than the suggested threshold (Table 15). This suggests a good quality of measurement. We analyzed the measurements of the formative constructs by means of examining the threat of multicollinearity. We generated the variance inflation factor (VIF) and the matrix of construct correlation values. None of the correlations between constructs are above 0.71 (Andreev et al. 2009). Table 16 shows the maximum variance inflation factor (VIF) is 2.73. The result suggests that multicollinearity is not a problem in our study, even with a more restrictive VIF value of 3.30 (Hair et al. 2010; Hair et al. 2011; Petter et al. 2007). The aforementioned correlation result gives, to a certain extent, discriminant validity to the constructs (Andreev et al. 2009).

Table 15. Loadings and quality criteria for reflective measure

Construct	Item	Standardized loading	AVE	Composite reliability	Cronbachs Alpha
Equivocal situation (ES)	ES1	0.81	0.67	0.86	0.76
	ES2	0.86			
	ES3	0.78			

We assessed the formative measurements by examining the indicator weights (obtained by running the PLS algorithm) and their statistical significance. The setting of this procedure was as follow: using the path weighting scheme, using the z-standardizes data metric option, setting the maximum number of iteration to 300, setting the stop criterion to $1 \cdot 10^{-5}$, and setting +1 as initial value for all outer weights. To assess the statistical significance of the measurements in the model, we set the number of bootstrap samples to 5000 and the number of cases was equal to the original sample as suggested by Hair et al. (2011). We set for ‘individual sign changes’ in the bootstrap setting (Henseler et al. 2009). Table 16 provides the weights of each item and their statistical significance.

Table 16. Variance Inflation Factor (VIF) and weights for formative measures – main model

Construct	Item	VIF 1 st Order	VIF 2 nd Order	VIF Model	Weight	Outer loading
Complexity in process (CP)	CP1	1.06	1.13	1.64	0.22	0.44
	CP2	1.06			0.93***	0.98***
Sophistication of technology (ST)	ST1	1.12	1.18		0.89***	0.97***
	ST2	1.12			0.25	0.54*
Challenges in project management (CPM)	CPM1	1.46	1.37		0.22	0.70***
	CPM2	1.44			0.56***	0.84***
	CPM3	1.44			0.22	0.70***
	CPM4	1.27			0.34**	0.65***

Construct	Item	VIF 1 st Order	VIF 2 nd Order	VIF Model	Weight	Outer loading
Lack of standards (LS)	LS1	1.96	1.37		0.04	0.70***
	LS2	2.53			0.74**	0.98***
	LS3	2.69			0.28	0.87***
Changes in external state (CES)	CES1	1.13	1.11	1.31	-0.45**	-0.12
	CES2	1.24			0.36*	0.66***
	CES3	1.13			0.23	0.48**
	CES4	1.33			0.74***	0.80***
Different frames of reference (DFR)	DFR1	1.00	1.11		0.50**	0.54***
	DFR2	1.00			0.84***	0.86***
Failure of evaluation methods (FEM)	FEM1	2.73	1.07	1.45	1.06**	0.99***
	FEM2	2.73			-0.08	0.76***
Lack of evaluation data (LED)	LED1	2.10	1.07		0.23	0.68***
	LED2	1.26			0.78***	0.95***
	LED3	1.05			0.16	0.64***
Bootstrapping results (n = 5000)						
*Significant at the 0.10 level (two-tailed)						
**Significant at the 0.05 level (two-tailed)						
***Significant at the 0.01 level (two-tailed)						

Several items were reported as not significant. Following Hair et al. (2014) recommendation when assessing formative indicators, we examined the outer loadings of the items further. It was found that nearly all the outer loadings were equal or above 0.5 and significant, except for CP1. The outer loading for CES3 was also slightly below 0.5 but it was significant. We decided to retain CP1 since the item represents different facets of the construct of interest and its removal would also compromise the construct's content validity. Finally, we opted to maintain the indicators since their existence and

relevance to the constructs resulted from/ were empirically supported by extensive qualitative studies.

The weights show the importance of each of the indicators in establishing the associated latent constructs. In the analysis, within the Content of evaluation, equivocal situations are rooted in: (1) the Complexity in process; this antecedent is highly associated with projects which involve extensive integration with other systems (CP2); (2) the Sophistication of technology; this antecedent is highly associated with projects which involve novel concepts (ST1); (3) the Challenges in project management; this antecedent is highly associated with projects which lack adequate control by senior management (CPM2); and, (4) the Lack of standards; this antecedent is highly associated with the lack of credibility of the evaluation criteria (LS2). Within the Context of evaluation, equivocal situations are rooted in: (1) the Changes in external state; this antecedent is highly associated with the shift in organizational priorities (CES4) and (2) the Different frames of reference; this antecedent is highly associated with the lack of complementary skills/abilities among decision-makers (DFR2). Within the Process of evaluation, equivocal situations are rooted in: (1) the Failure of evaluation methods; this antecedent is highly associated with the absence of predefined evaluation procedure(s) (FEM1) and (2) the Lack of evaluation data; this antecedent is highly associated with the unavailability of essential data to support decision-making (LED2).

Furthermore, we found the CES1 (changes in law, rules or regulations) and FEM2 (application of evaluation method or tool) weights have negative signs (CES1 has a significant weight). We examined the correlations between the CES and FEM indicators. We found that the correlations were all positive. The highest CES and FEM correlations are 0.31 (CES1 and CES4) and 0.80 (FEM1 and FEM2) respectively. According to Cenfetelli and Bassellier (2009), co-occurrence of negative and positive indicator weights can take place when a suppressor effect is involved. A change in sign might be the result of the magnitude of correlations among the formative indicators and a negative CES1 sign can be expected when CES2 (changes in organizational structure), CES3 (negative effect of politics), and CES4 (changes in organizational priorities) are equal; increased amounts of CES1 (changes in law, rules or regulations) will reduce the degree of the CES construct. A similar interpretation can be applied to FEM as well.

We modeled the Content, Context, and Process within the evaluation frames as second-order superordinate constructs. These second-order aggregate constructs were treated as hierarchical components using repeated indicators from their respective constituent antecedents of equivocal situations. Thus, we ran the PLS algorithm to directly measure the higher-order constructs by employing all the items of their lower-order constructs (Cenfetelli and Bassellier 2009) and examined threat of multicollinearity as well. The maximum VIF is 1.37, which is still below the 3.30 threshold. Figure 20 summarizes the path coefficients and their significance within the structural model. This specifies that all the hypotheses are supported.

Figure 20. PLS result – main model (N=111)

R^2 (coefficient of determination) is one of the criteria used to assess the structural model. We ran the PLS algorithm with the aforementioned settings and obtained a value of 0.47 for the endogenous latent variable of equivocal situation (ES). This value suggests a fairly moderate level (Hair et al. 2011). Moreover, we ran the blindfolding procedure to compute the cross-validated redundancy index for the equivocal situation construct (ES). The omission distance was set to 7, so that the computation would not yield an integer. The Stone-Geisser Q^2 for this construct is 0.31. A value above 0 (zero) indicates the model's overall predictive relevance and an acceptable model performance (Hair et al. 2011).

We computed effect size (f^2) and predictive relevance (Q and q^2). The f^2 and q^2 for Content, Context and Process are shown in Table 17. The Content of evaluation has moderate to strong effect size and fairly moderate degree of predictive relevance. Conversely, the Context and Content of evaluation have rather weak effect size and predictive relevance. The effect size f^2 and the relative impact of latent variables on the predictive relevance substantiate the impact of Content of evaluation, which consists of ST, CPM and LS, toward an equivocal situation (ES). At this point, the model and the measurements have undergone the assessment procedure. The results indicate that the measurement model and the structural model are reliable and valid. The model underlines the provision of a conceivable explanation for the equivocality antecedents and the possibility to predict equivocal situations during IS/IT project evaluations. Accordingly, proper implications which explain and forestall the occurrence of an equivocal situation can be derived from the results.

Table 17 f^2 and q^2 for the main model

	f^2	q^2
Content	0.20	0.10
Context	0.05	0.03
Process	0.06	0.03

The use of formative measurements allowed us to determine the impact of each separate antecedent on the endogenous construct of an equivocal situation. A combination of this impact with the index value of each indicator produces a so-called

importance-performance matrix (Hair et al. 2014). Given a certain endogenous latent variable, this analysis produces a priority map, for organizations, of different project evaluation areas that need attention (Hair et al. 2014). The analysis was conducted by rescaling the indicators to a range of 0 to 100. This step produced the performance score of each latent construct. The next step was combining the performance score with the total effects of each latent construct in the structural model and plotting these two scores as a matrix. Figure 21 visualizes the relative performance and importance among antecedents of equivocal situations. To lessen the equivocal situation level, actions should be taken along the lines of relatively high importance and performance. An importance score in the matrix indicates a change in equivocal situation as a result of an increase of one point within the antecedents. The performance score indicates the potential for improvement. In our case, the higher the performance score, the more room for further improvement. CPM, which lies on the furthest right side of the plot, indicates a high-impact antecedent to the occurrence of an equivocal situation; thus, it is important to devote exceptional attention to this antecedent. ST, on the other hand, indicates organizations may need to improve the evaluation and prevent equivocal situations by unraveling the issues within this antecedent.

Additionally, we run the model using ADANCO version 1.1.1 (<http://www.composite-modeling.com/>) to examine the Goodness of model fit; this is done by measuring the discrepancy between the empirical correlation matrix and the implied correlation matrix of particular model (Henseler and Dijkstra 2015). The program provides the Goodness of model fit in terms of standardized root mean squared residual (SRMS), least square discrepancy (dULS), and geodesic discrepancy (dG), for both saturated and estimated model. These three criteria show the difference strength between an empirical correlation matrix and an implied correlation matrix; lower values mean a theoretical model has a better fit (Henseler and Dijkstra 2015). The measurement model is similar in both saturated and estimated model; however, all constructs in the saturated model are correlated and not restricted by the predetermined relationships (Henseler and Dijkstra 2015). Moreover, a bootstrap-based estimation of both 95 and 99-percentiles are also reported for the three criteria as to determine the 'true' likelihood of the proposed theoretical model.

Since the model involves a set of repeated indicators, we run the model by including only the first-order construct in the first step. In the second step, we run the model by including the higher-order construct and the indicators. The results are shown in Table 18 and Table 19. One criteria, i.e., the geodesic discrepancy (dG), shows the theoretical model is likely to be 'true' for both first- and higher-order constructs and for both saturated and estimated model.

Table 18. Goodness of model fit for first-order constructs

Criteria	Goodness of model fit					
	Saturated model			Estimated model		
	Value	HI95	HI99	Value	HI95	HI99
SRMR	0.12	0.10	0.11	0.12	0.10	0.11
dULS	4.34	3.12	3.86	4.34	3.12	3.86
dG	1.00	1.15	1.31	1.00	1.15	1.31

Table 19. Goodness of model fit for higher-order constructs

Criteria	Goodness of model fit					
	Saturated model			Estimated model		
	Value	HI95	HI99	Value	HI95	HI99
SRMR	0.13	0.08	0.09	0.13	0.08	0.09
dULS	5.18	2.08	2.43	5.18	2.08	2.43
dG	0.90	0.96	1.09	0.90	0.96	1.09

Figure 21. Importance-performance matrix – main model

6.6 Discussion

Our empirical examination shows three interesting points. First, the theoretical model seems to be fairly robust in predicting the occurrence of an equivocal situation since all the hypotheses are supported by the empirical data. The empirical findings from our quantitative part indicates significant positive relationships between the evaluation frame constructs of Content, Context, and Process (comprised of eight antecedents) and the equivocal situation construct. Moreover, nearly all the antecedents have significant positive contributions to their corresponding evaluation frame constructs, except for P4 (Complexity in process – CP) and P10 (Failure of evaluation methods – FEM). These two antecedents have positive contributions but not significant according to our data. The result implies that the antecedents within our evaluation framework lead to the occurrence of equivocal situations during IS/IT project evaluations. Conceivably, we recommend these antecedents should be taken into account as an early warning sign of an equivocal situation before embarking on or during an evaluation. Employing project evaluations that suffer from these signs will result in decision-makers encountering dilemmas and they will be hindered in making informative and purposeful decisions.

Second, we further reveal distinct impacts by different categories of antecedents on the occurrence of an equivocal situation. The strongest source of an equivocal situation within the Content of evaluation is the Challenges of project management. This category includes (1) inadequate senior management control over project execution (CPM2) and (2) the vagueness of the project charter as the basis for managing the project (CPM4). CPM2 and CPM4 are the two-top issues based on the weights. The strongest source of an equivocal situation within the Context of evaluation is the Different frames of reference. This category includes (1) difficulty in gaining mutual perception due to different backgrounds (DFR1); and, (2) the lack of complementary skills/abilities among decision-makers to proceed with effective evaluation (DFR2). DFR2 is the top issue based on the weights. The strongest source of an equivocal situation within the Process of evaluation is the Lack of evaluation data. This category includes the unavailability of data to support the evaluation and decision-making (LED2). LED2 is the top issue based on the weights. Table 20 summarizes the findings.

Table 20 Significant emerging issues of equivocality in project evaluations

CP2*	The development process of the project involved a lot of integration with other systems
ST1	The concept of the IS/IT product was very novel
CPM2	Senior management did not control the project adequately in order to keep it on track
CPM4	The project charter, as a basis for managing the project, was vague
LS2	The evaluation criteria were not considered credible by the decision-makers
CES1	Changes in law, rules or regulations had a significant impact on the project
CES2	Changes in organizational structure external to the project had significant impact on the project
CES4	Resources were shifted away from the project because of changes in organizational priorities
DFR1	The decision-makers had different backgrounds
DFR2	The decision-makers had skills and abilities that did not complement each other

FEM1*	A predefined procedure was not applied to evaluate the project and to decide the next course of action
LED2	It is difficult to evaluate the project effectively because some of the needed data were NOT available
*The issues are significant as the first-order indicators; however, the developed second-order constructs within the evaluation frame are not significant in relation to the occurrence of equivocal situations	

The emergence of Challenges in the project management category reminds us of the importance of (basic) IS/IT project management. Although it may be seen as an old problem, the process of managing IS/IT projects still seems to be a tough practice such as the lack of senior management commitment toward IS/IT investment (CPM2). Yet, these issues have severe consequences for project evaluations and subsequent decisions. Quoting Nolan and McFarlan (2005), “*A lack of board oversight for IT activities is dangerous; it puts the firm at risk in the same way that failing to audit its books would.*” This underlines the urgency to raise the awareness and attention amongst top management toward critical IS/IT investments, especially projects which involve: (1) novel concepts and technologies (ST1) and (2) extensive integration with other systems (CP2), as well as to increase the understanding of their role in attaining unequivocal evaluations. This could be realized by setting the details of the project charter (CPM4) properly, together with the people within the project management structure and by improving the effectiveness of the utilized framework or tools to control such projects.

Improving the governance framework, like COBIT, which integrates value generation and risk management with IT governance and management, and of IS/IT development methodologies like Agile, can enhance monitoring, evaluating, and delivery of IS/IT projects (De Haes et al. 2013; Nelson and Morris 2014). Wu et al. (2011b) suggest the utilization of untraditional project management practices for innovative and large IS/IT projects which involve high levels of uncertainty. A dual project management life-cycle process is proposed to effectively manage the ‘radical innovation points’ and to achieve project success (Wu et al. 2011b).

In relation to the antecedent of Different frames of reference, studies related to top management teams stress the potential problems of increasing diversity in a group of

decision makers (e.g., Knight et al. (1999)). Despite the advantages of diversity, such as providing wide-ranging alternative actions for the projects, diverse backgrounds, such as functional backgrounds, could complicate a decision-making process if it is not handled carefully (Knight et al. 1999). Moreover, studies within group decision-making may offer useful techniques for enhancing group decisions when facing equivocal situations, to support or as an alternative to: Dialectical Inquiry, Devil's Advocacy, and Consensus. Several studies suggest the use of Dialectical Inquiry to provide critical evaluations and solve ambiguous problems (Priem and Harrison 1995; Schweiger et al. 1986). This technique could also be used to bring out concrete alternatives for certain project decisions such as project modification and redirection.

Third, we demonstrate from the analysis that the model shows a moderate level of R^2 and acceptable predictive relevance and performance. The applied formative measurement allows for individual item assessment that identifies the salient issues within each of the categories of antecedents. The performance-importance matrix shows the importance of different antecedents of equivocal situations and the potential antecedents that warrant remediation and improvement. Positive antecedent effects means that lessening specific issues within the identified antecedents will help organizations to forestall the prevalence of equivocal situations when employing project evaluations.

The revealed antecedents of equivocality in project evaluations inform us on the potential issues surrounding project executions and evaluations which may lead to ill-defined situations. The situations are posited to hinder purposeful decisions; however, the actual impacts of equivocal situations in project evaluations toward decisions and project implementation remain a puzzle and need solving. Despite experimental studies which address the relation between equivocal information and decisions to escalate or to delay abandonment (e.g., Pfeiffer et al. (2007)) very little is known about equivocal situations in project evaluations and their consequences. Moreover, there is still a lack of theory to support the relation between equivocal situations and project outcome.

6.7 Conclusion

This study offers a meaningful contribution to research and practice. Although it is recognized that equivocality plays an important role in affecting the continuation of IS/IT projects, the immediate antecedents of this phenomenon are not well established. To address this gap, this study focuses on developing a model that can be used to predict an equivocal situation when evaluating and deciding on the continuation of an IS/IT project and to identify the salient drivers. By subscribing to Bowen's decision dilemma theory, this study contributes by synthesizing and consolidating extant literature on IS/IT project continuation decisions and equivocality. The study starts with an exploratory phase aimed at inductively deriving the antecedents of equivocal situations. Current knowledge is advanced by using an evaluation frame drawn from IS/IT evaluation literature; a conceptual model is explicated that captures the key issues of project evaluation and aligning these issues with the identified antecedents of equivocal situations. The thorough literature review and the complementing qualitative field studies provide firm foundations for the proposed theoretical model. From a theoretical perspective, this study contributes to the development and validation of the instruments to measure equivocal situation and their antecedents.

The quantitative analysis shows the path coefficients and their significance for each of the antecedents. It is revealed that the salient drivers of equivocal situations lie within the Content, Context, and Process of evaluation. Specifically, this points to the involvement of sophisticated technologies in the projects and the challenges to implement the projects. These issues make IS/IT projects, as evaluation objects, harder to evaluate and hinder decision-makers in achieving the evaluation goals. Likewise, within the Content of evaluation, the establishment of evaluation criteria is also found to be one of the salient drivers inducing equivocality. Within the Context of evaluation, the influences from the external environment and the involvement of diverse people in an evaluation are shown to confound project evaluations as well. Within the Process of evaluation, the unavailability of data to support evidence-based evaluations is shown to lead project evaluations into equivocal situations by steering decision-makers away from making purposeful decisions.

Additionally, we offer invaluable insights for practitioners who conduct IS/IT project evaluations. The weights of the individual items show the importance of

individual issues within each antecedent category that can lead to equivocal situations. The matrix provides an insight of the highly relevant antecedents and the potential areas which could be remedied and improved by organizations in order to lessen the emergence of an equivocal situation when embarking on project evaluations.

Around 42 per cent of participants of the survey are willing to discuss their responses further. Hence, post hoc examination of the survey is viable to gain additional insights related to the relationships among constructs, especially the insignificant ones. Follow-up study on how practitioners cope with equivocal situations may also be warranted. A limitation entailed in this study concerns heterogeneity that may hamper PLS analysis. Additional studies should focus on analyzing the potential heterogeneous groups within the data. Furthermore, the data collected via the survey may be biased; therefore, conclusions based on this study must be interpreted with caution. Finally, this study sheds some light on the underlying mechanisms of equivocal situations and helps practitioners to assess and forestall equivocal situations when evaluating and deciding on the continuation of their IS/IT projects.

¹³ This chapter is based on a paper presented and published in the proceedings of the 2015 48th Hawaii International Conference on System Sciences (HICSS 2015).

Abstract

Project evaluations are highly crucial for organizations to manage their information systems and technology project portfolios. This study postulates equivocal situations as the source of dilemmas hindering stakeholders to achieve proper evaluation and purposeful decisions. We examine three factors that are conceived to have high association with equivocal situations when evaluating IS/IT projects; Challenges in project management, Different frames of reference and Lack of evaluation data. The developed model is tested using a survey data of IS/IT professionals through PLS. We find the three factors are significantly affecting the occurrence of equivocal situations with the highest contribution come from the Challenges in project management. Multi-group examinations reveal distinct impacts of the three factors within Public versus Private sector and High versus Low projects in the project evaluation ladder. Post hoc interviews suggest several interesting points especially on how to cope with equivocal situations.

7.1 Introduction

The distinctiveness of IS/IT projects compared to other types of projects are known by (1) the difficulty in dealing with the volatilities of requirement and scope from numerous stakeholders; (2) the lack of projects' visibility that leads to problem of estimating project completion; and, (3) the difficulty in defining precise benefits (Ewusi-Mensah 1997; Keil and Flatto 1999; Sauer et al. 1999). Compared to the typical IS/IT projects, large-scale IS/IT projects are recognized by their (1) longer duration; (2) larger requisite resources; (3) more complex IS/IT products; and, (4) more involvement of multiple stakeholders (Kipp et al. 2008). Moreover, the 'black swan' IS/IT projects are associated with the occurrence of rare and unpredictable events within project execution which often destructive (Buhl 2012). These events may be caused by the lack of experience to estimate the IS/IT project risk and the failure to anticipate the interconnectedness of IS/IT projects (Buhl 2012). The examples of large-scale and 'black swan' IS/IT projects show projects which are seemed to 'take on a life of their own' and are often deemed to fail eventually (Buhl 2012; Buhl and Meier 2011; Lee et al. 2012).

Evaluations are promoted to identify issues within project management and obtain early warnings based on the projects' current status; thus, they provide insight into which strategy will be well-positioned to accomplish the IS/IT investment objectives (Pan et al. 2006). Farbey et al. (1999) outline that the aim of evaluation can be attained by employing the process(es) of evaluation at different stages of IS/IT development to ascertain impact of the IS/IT strategy and to warrant the continuous support on such investments. Evaluation are beneficial since they allow organizations to control projects and to compare the merit and worth of different projects competing for limited resources (Farbey et al. 1992). Through the use of appraisal methods and techniques, evaluations allow decision-makers to benchmark and define costs, benefits, risks and the implications of IS/IT projects (Irani et al. 2005).

However, prior studies reported evaluations of IS/IT projects are challenging despite their importance to make purposeful decisions. Organizations are experiencing problems applying evaluations in practice. Decision-makers may interpret the projects' worthiness from unclear indications and get trapped in dilemmatic situations due to a lack of clarity and understanding of the situations. Equivocality as the heart of equivocal situations is conceived as the important determinant in affecting the continuation

decisions. Our earlier chapters have delineated the role of equivocality and revealed the causes of equivocal situation in project evaluation. The findings, which pinpoint equivocal situations as problems hampering project evaluations, support what past studies have highlighted (Abdel-Hamid et al. 1993; Mähring and Keil 2008).

Arguably, reducing the equivocal situations in project evaluations is desirable to make improved and purposeful decisions as well as to reduce the chance of improper decisions. By subscribing to Bowen's Decision Dilemma theory we follow the conjecture that continuation decisions of IS/IT projects are seen more as dilemmas rather than errors of decision-making. The dilemmas may hinder decision-makers to make informative and purposeful decisions and to craft proper strategies. Despite support from several studies showing the importance of equivocality in affecting continuation decisions (Sleesman et al. 2012) the causes of equivocality are not well recognized. Likewise, empirical support to substantiate the relations between the causes and the equivocal situations is still limited. Build upon our prior investigation of the relation between the causes and the equivocal situations; this study advances a model to examine the potential heterogeneous groups and to glean insights into the prevailing causes of equivocal situations in practice. Specifically, we endeavor to address the following research question:

How can salient drivers of equivocal situations in IS/IT project evaluation be compared across groups and what lessons can be learned from the prevailing causes of equivocal situations?

To answer the above research question, we develop a theoretically grounded research model built upon extant studies and utilize a mixed-method research combining quantitative and qualitative methods. The mixed-method is utilized to differentiate the causes of equivocal situations as well as to perform post hoc examination of the quantitative part. We aim to reveal the salient drivers of equivocal situations, to compare them across conceivable groups, and to obtain insights from the prevailing causes of equivocal situations. This study hence provides early evidence of equivocal situations within project evaluations and offer noteworthy lessons from practice.

7.2 Theoretical Foundation and Hypotheses Development

We defined equivocal situations in IS/IT project evaluations based on our prior literature review as the state when decision-makers or evaluators encounter a lack of clarity and confusion in deciding upon the continuation of a project, which occur when lack of knowledge or diverse knowledge exists in regard to information surrounding the project, especially its past performance and future attainment.

In this study, the *Equivocal situation* (ES) construct refers to the extent to which evaluation of the project is hampered by equivocality. We highlighted the characteristics of equivocal situations that serve as indicators. The equivocal situations are indicated by (1) a lack of clarity of the project condition and confusion toward the next course of actions; (2) the existence of different interpretations among decision-makers concerning information surrounding the projects; and, (3) the indeterminacy of analyzed data to base the decision on. Conceivably, these indicators show the extent of equivocality in the project evaluations. Next, we adapted items from (Carson et al. 2012), (Watts Sussman and Guinan 1999), (Daft and Macintosh 1981) and (Lim and Benbasat 2000) to align our indicators with the extant studies.

Furthermore, extant studies indicated several problems related to equivocal situations. For instance, lack of clarity about projects' success and failure criteria, vagueness of project charter, or ambiguity of information surrounding the project execution (Keil and Robey 1999; Mähring and Keil 2008; Snow and Keil 2002a). These problems seem to play important roles in driving the dilemma in project evaluations and hindering purposeful decision-making. We consolidated the identified problems from earlier studies and categorized them into factors posited as the causes of equivocal situations that occur in project evaluations. Considering our earlier findings we parsimoniously form three factors posited to have high association with the occurrence of equivocal situation. The three factors are *Challenges in project management* (CPM) – the extent to which the IS/IT project encounters substantial management challenges, *Different frames of reference* (DFR) – the extent to which evaluators/decision-makers have diverse viewpoints when evaluating the project, and *Lack of evaluation data* (LED) – the extent to which evaluators/decision-makers use data surrounding the project to support decision-making. The proposed model is opted to form a less complex model with straightforward hypotheses and interpretations, without losing considerable predictive

relevance and explained variance. The post-utilization of qualitative method hence can be focused on the important problems of equivocality in IS/IT project evaluation. In addition, the insights gained from the analysis should be less difficult to convey and understand.

Based on the literature review and our discussion regarding the sources of equivocality, we model the Equivocal situation as a dependent variable affected by the aforementioned factors. The three factors that serve as independent variables are connected by direct relationships. Figure 22 illustrates the research model. We hypothesize that:

- H1: Challenges in project management is positively associated with the occurrence of an Equivocal situation
- H2: Different frames of reference is positively associated with the occurrence of an Equivocal situation.
- H3: Lack of evaluation data is positively associated with the occurrence of an Equivocal situation

Figure 22. Research model – alternative

7.3 Research Design

We constructed the measurement items by adopting scales that were relevant within our constructed factors. The scales were reworded to be suitable within our research domain. Prior to data collection, two rounds of Q-sorting exercises were held. The result of an average 'hit ratios' of 86 per cent, an average raw agreement of 85 per cent, and an average Kappa of 83 per cent showed that the items have adequately tapped to our constructed factors (Moore and Benbasat 1991). After ensuring substantive validity of the constructs we continued the empirical part by developing the questionnaire based on the result of the Q-sorting exercises. Table 21 shows the measurements of the developed constructs.

By using an online tool distributed as a web link, participants were asked to recall a recent review or evaluation of a challenged IS/IT project they involved in and to keep this one project in mind throughout the questionnaire. The equivocal situations in project evaluations were assessed by asking the participants the extent of the occurrence for each of the aforementioned characteristics of equivocal situations. The factors posited to drive equivocal situations were assessed as well. The 7-point Likert scales ranging from (1) Not at all/Strongly disagree and (7) Very great extent/Strongly agree were used to measure the constructs.

The invitations to participate were sent through several relevant LinkedIn groups and organizations of IS/IT professionals. Calculating Cohen's power of regression analysis at $\alpha=0.05$ with a medium effect size ($f^2=0.15$) and a power level of 0.8, a sample of at least 84 was needed (Hair et al. 2014). Based on report of the survey's web link around 252 people accessed the survey and 111 participants (44%) completely filled in the survey.

Profiles of the survey respondents and the chosen project are described priority in Chapter 6 (cf. Section 6.6). Concerning the decision of evaluation, 18% of the projects are suffering total and substantial abandonment. 51% of the projects are categorized as escalated, and another 26% of the projects are continued as planned. These decisions as well as the actual implementation of the project are depicted in Figure 23. The actual implementation figure outlines that around half of the projects are deemed to be not completely finish and not fully successful. In the post hoc analysis, we divide the projects into: (1) two groups of Public and Private sectors based on the industry, and (2) two

groups of High and Low project evaluation ladder. The grouping will be explained later in detail (Figure 24).

Table 21. Measurements of the constructs – alternative model

ES1	The project status or condition was hard to ascertain due to different interpretations among decision-makers of information surrounding the project
ES2	Decision-makers lacked clarity and understanding of the condition of the project and thus were confused concerning the next course of action
ES3	It was problematic to analyze the condition of the project since insufficient objective data was available to base the decisions on
CPM1	The project had NOT set out project milestones adequately
CPM2	Senior management did NOT control the project adequately in order to keep it on track
CPM3	Ineffective communication among people in the project management structure
CPM4	The project charter, as a basis for managing the project, was vague
DFR1	The decision-makers had different backgrounds
DFR2	The decision-makers had skills and abilities that complement each other (reverse)
LED1	The data used were accurate enough to evaluate the project (reverse)
LED2	It is difficult to evaluate the project effectively because some of the needed data were NOT available
LED3	The data were at an appropriate level of detail to evaluate the project (reverse)

Figure 23. Decision and implementation of project

Figure 24. Project groupings based on sector and evaluation ladder

7.4 Analysis and Result

To test the measurement model and to analyze the direction and strength of each relationship we utilized PLS which is well suited for theory building and prediction as well as handling mixed reflective and formative measures (Ringle et al. 2012). SmartPLS version 2.0 (M3) was used to run the PLS analysis (Ringle et al. 2005).

Equivocal situations were assessed based on values of indicator loadings, the average variance extracted (AVE), composite reliability, and Cronbach's alpha. All values are higher than the suggested threshold (0.70, 0.50, 0.70, and 0.70, respectively) (Hair et al. 2010; Hair et al. 2011). A good quality of measurements can be derived from these assessments. Since the three factors were using formative indicators, an examination of the construct correlations matrix and variance inflation factor (VIF) were necessary to detect the threat of multicollinearity. None of the correlations between constructs are above 0.71, which provides discriminant validity of the constructs (Andreev et al. 2009). The result for VIF was below 3.3 which suggest no threat of multicollinearity (Hair et al. 2010; Hair et al. 2011; Petter et al. 2007).

Furthermore, the formative measurements were examined by running the PLS algorithm to obtain their weights and running the bootstrap to obtain their statistical significance. The number of bootstrap samples was set to 5000 and the number of cases was equal to the original sample (Hair et al. 2011). Figure 25 visualizes the PLS result and provides the weights of each item and their statistical significance. CPM3, LED1 and LED3 were reported to be not significant. However, the outer loadings of these items

were 0.65, 0.47 and 0.45 respectively and significant. These items then were retained based on Hair et al. (2014).

Figure 25 also shows the path coefficients and their significance within the structural model. This specifies that all the hypotheses are supported. The resulted R^2 was 0.47, which suggests a fairly moderate level (Hair et al. 2011). Moreover, the Stone-Geisser Q^2 for Equivocal situation construct was 0.31, which indicates the overall model’s predictive relevance and an acceptable model performance (Hair et al. 2011). Moreover, the effect size f^2 and q^2 for CPM, DFR and LED are shown in Table 22. CPM has relatively moderate to strong effect size compare to DFR and LED. Likewise, CPM has fairly moderate degree of predictive relevance compare to DFR and LED.

Figure 25. PLS result – alternative model (N=111)

The PLS result substantiates the impact of CPM, DFR and LED on an equivocal situation (ES). Since the independent variables were treated as formative construct, impact of individual indicators on an equivocal situation (ES) can be further

determined by evaluating their path weights. Thus, the importance of each indicators associated to the latent constructs are shown by the values of weights. The PLS result shows that (start from the highest value): (1) within the *Challenges in project management* (CPM), the identified problems which are highly associated with equivocal situations in project evaluations are the inadequate control of senior management (CPM2) and the unclear or vague project charters (CPM4). Additionally, projects which do not adequately set out project milestones (CPM1) will lead to equivocal situations. Within the *Different frames of reference* (DFR), the identified problems which are highly associated with equivocal situations in project evaluations is the lack of complementary skills and abilities among decision-makers (DFR2) when conducting evaluations. Additionally, the different background among decision-makers also contributes significantly to equivocal situations (DFR1), e.g., different functional department. Within the *Lack of evaluation data* (LED), the identified problem which highly associated with equivocal situations in project evaluations is the unavailability of essential data to support decision-making (LED2).

Table 22. f^2 and q^2 for the alternative model

	f^2	q^2
CPM	0.19	0.10
DFR	0.06	0.04
LED	0.14	0.07

7.4.1 Post Hoc: Multi-group Analysis

We conducted multi-group analysis by separating the samples into two groups. First, we constructed two groups of Public and Private sectors based on the industry. Organizations within the Public sector include education, government, healthcare and non-profit. The rest of the industry is considered as private sector. Prior research of information systems in public and private sectors reported several differences in managing IS/IT projects; hence, these influence the evaluations and the decision-making of the projects. For instance, differences in measuring output or productivity and performance might lead to different manner in decision-making (Mohan et al. 1990).

There are several limitations in the public sector that could lead to different equivocality problems during project evaluations and decision-making, such as divided authority over IS/IT projects, involvement of multiple stakeholders with competing goals, and interrelated internal process (Rocheleau and Wu 2002).

Second, we constructed two groups of High and Low project evaluation ladder based on the taxonomy of IS applications (Farbey et al. 1995). Project evaluation ladder refers to the different types of IS applications that have different complexity and difficulty when deploying the evaluations (Farbey et al. 1995). Evaluating high ladder projects are posited to be more experimental and judgmental processes which conceivably have a distinct set of problems leading to equivocal situations (Farbey et al. 1995). The group of High evaluation ladder includes projects which were aiming for business transformation, strategic system, and new service or product development. The group of Low evaluation ladder includes projects which did not have the aforementioned purposes, such as projects aiming for direct value added system, automation, or mandatory changes.

We found several interesting points. First, CPM3 and CPM4 significantly had a strong contribution to CPM construct in the Public sector but not CPM1 and CPM2. Conversely, CPM1 and CPM2 had a strong contribution to CPM construct in the Private sector but not CPM3 and CPM4. It seems that the ineffective communication within people in project management structure (CPM3) and the vagueness of project charter (CPM4) are contributing particularly and have greater impact to the equivocal situations in project evaluations occurred within the Public sector compare to the Private sector. On the other hand, equivocal situations caused by the *Challenges in project management* in the Private sector are more concerned with the project planning and control; these are the inadequately set out project milestones (CPM1) and inadequate devotion of senior management to keep the project on track (CPM2).

Second, within the *Different frames of reference* construct, the different background of decision-makers (DFR1) was not significant in the Public sector. Equivocal situations within the Public sector are solely attributed to the lack of complementary skill and abilities among decision-makers (DFR2) instead of caused by different background of the decision-makers (DFR1). Third, examination of the groups of High and Low project evaluation ladder revealed, intriguingly, comparative results. The results showed that

projects in the group of High evaluation ladder share similar significant and non-significant problems of equivocality with projects in the group of Private sector; the significant problems were CPM1, CPM2, DFR1 and DFR2. Conversely, projects in the group of Low evaluation ladder have somewhat similar significant and non-significant problems of equivocality with projects in the group of Public sector, except that CPM2 was significant in the Low evaluation ladder group and CPM3 was significant in Public sector group. For LED2, the problem was consistently significant across groups. Table 23 summarizes these findings.

Table 23. Multi-group analysis (alternative model)

	Public (N=33)	Private (N=78)	Low (N=50)	High (N=61)
CPM1	-0.18	0.62**	0.23	0.44*
CPM2	0.14	0.43*	0.46*	0.48**
CPM3	0.44**	0.07	0.20	0.13
CPM4	0.81***	0.19	0.38**	0.36
DFR1	0.32	0.54**	0.23	0.71***
DFR2	0.93***	0.82***	0.95***	0.71***
Bootstrapping results (n=5000) *Significant at the 0.10 level (two-tailed) **Significant at the 0.05 level (two-tailed) ***Significant at the 0.01 level (two-tailed)				

Finally, we examine whether the different impacts (both as weights and path coefficients) between the groups of Public versus Private and High versus Low project evaluation ladder are significant. We employ the multi-group analysis (MGA) feature from SmartPLS 3 (version 3.16) and assemble the following results as shown in Table 24 and Table 25:

Table 24. Weights difference between groups (alternative model)

	Absolute weights difference (Public-Private)	Absolute weights difference (High-Low)
CPM1 → CPM	0.81**†	0.20
CPM2 → CPM	0.29	0.01
CPM3 → CPM	0.37	0.10

	Absolute weights difference (Public-Private)	Absolute weights difference (High-Low)
CPM4 → CPM	0.62**†	0.05
DFR1 → DFR	0.23	0.45*‡
DFR2 → DFR	0.11	0.21
LED1 → LED	0.65	0.41
LED2 → LED	0.35	0.12
LED3 → LED	0.22	0.21
Bootstrapping results (n=5000) *Significant at the 0.10 level (two-tailed) **Significant at the 0.05 level (two-tailed) ***Significant at the 0.01 level (two-tailed) † Significant based on both Parametric Test and Welch-Satterthwait Test ‡ Significant based on Henseler's MGA		

Table 25. Path coefficients difference between groups (alternative model)

	Absolute path coefficients difference (Public-Private)	Absolute path coefficients difference (High-Low)
CPM → ES	0.27	0.22
DFR → ES	0.01	0.12
LED → ES	0.19	0.26**†‡
Bootstrapping results (n=5000) *Significant at the 0.10 level (two-tailed) **Significant at the 0.05 level (two-tailed) ***Significant at the 0.01 level (two-tailed) † Significant based on both Parametric Test and Welch-Satterthwait Test ‡ Significant based on Henseler's MGA		

It turns out that between Public and Private group the difference impacts of CPM1 and CPM4 are significant for the alternative model. Specifically, the impact of CPM1 is higher for the Private sector and CPM4 is higher for the Public sector. For High and Low project evaluation ladder the impact of DFR1 is different significantly as well, i.e., the impact of DFR1 is higher for projects within the High evaluation ladder group than project in the Low evaluation ladder. Moreover, impact of the Lack of evaluation

data (LED) is different significantly between the projects within High versus Low evaluation ladder. The impact of LED is higher for projects in the High evaluation ladder than projects in the Low evaluation ladder.

7.4.2 Post Hoc: Interview Analysis

Around 42 per cent of participants in the survey were willing to discuss their responses further. Hence, post hoc examinations of the survey responses were viable to gain additional insights concerning the relationships among constructs. Explorations on how practitioners cope with the equivocal situations were warranted as well. Based on the participants' responses in the questionnaires, we obtained six interviews with the informants who were involved in the project evaluations and had experience confronting with equivocal situations at the time of evaluations. Three projects were categorized as escalated (i.e., continue with additional resources or continue with reduction) and another three were categorized as terminated (i.e., substantial abandonment or redirection). A mix of informants within the categories of escalated and terminated projects was expected to provide a wide range of insights on the emergence of equivocality and its impact on the project decisions as well as how they coped with the equivocal situations during project evaluations. Thus, we elaborated on the problems they had and the way they handled them during our discussions. We were able to elicit several interesting points from these post hoc interviews.

First, the vagueness of project charters (CPM4) was sometimes prevailed deliberately to ensure flexibility of the projects. This was also related to the organizational culture, as admitted by one of the informants "*[The relatively vague project charter occurred] because we have a hard time being concise on what we want. We keep it vague and keep room to play. It's a cultural aspect. We keep things vague because of flexibility.*" This practice is not encouraged by project management methods which require the development of a clear project charter and a structured plan, as admitted by the informant "*Vague project charters are not good because in the end, someone has to make a decision. If the business side does not make a decision, IT will. In IT, they only have to choose between a 0 and a 1. If the business people do not make a decision, it's up to IT which knows less about business.*" It is suggested that employing project management methods should lessen the problem. In certain cases, the vagueness of the project charters needs to be clarified and refined

iteratively; otherwise, the initial problem of equivocality may grow larger. Examples of this issue are undefined and conflicted project goals at the beginning of projects. Later on, this unresolved equivocality may lead to different perceptions or interpretations toward information surrounding the projects, which will create difficulty to ascertain the project status or condition. One of the informants underscored “*The decision-makers come from the different departments, I have just discussed [the project status and condition] and they have different goals. This particular project started from a technical point of view, the implementation should not have been carried out by the technical part of the organization, resulting in severe business implications.*”

Second, the ineffective communication (CPM3) seemed to be the result of different perceptions, priorities, roles, and responsibilities among people in the project management structure as well as the result of having large-scale projects. One of the informants highlighted “*[The ineffective communication was occurred] because of the large time scale of this implementation, different people with different opinions were involved.*” Another informant stated “*There are a lot of levels and different groups, teams and department. It's not always in our (business side) but also in the application and technology side. All those teams and persons have a place in the product development and should be heard at least.*” In this case, teambuilding, involvement and engagement are recommended to intensify the communicative atmosphere and cope with the problem, as one of the informants suggested “*The solution is teambuilding; team building events, team time-outs, all kind of extra activities to really form a joint group.*” Another informant highlighted “*Keep everyone involved. Be open in your communication.*” Good practice of communication was suggested, as one of the informants commented “*You try to inform people. Newsletters and information on intranet are important. It is important to state the scope of the project. Communication works.*”

Third, the backdrop of lacking complementary skill and abilities among decision-makers (DFR2) in projects evaluations was attributed to the distinct professional experience within decision-makers or evaluators. One of the informants underlined “*They [the decision-makers] were quite different because the CEO was from sales; the CFO was a corporate controller. Their thoughts were not always 100% in the same direction.*” This issue seems leading to one of the equivocal situation characteristics as well, i.e., the existence of diverse or lack of knowledge. Later on, decision-makers were compelled to exchange opinions, share meanings and beliefs towards the projects. One of the

informants stressed “*Rather than trying [to bridge the difference in opinions and meanings] and understand one another, they realized that it was not just the case. Knowledge that [was] different exist.*” In this case, decision-makers are suggested and encouraged to create and compromise the solutions for the projects’ next course of actions (Brun and Saetre 2008) as well as nurturing solid awareness to further cope with such issue, instead of discovering the problems encountered in the evaluations.

Forth, unavailability of the requisite data to proceed with effective evaluations and to support decision-making (LED2) was attributed to several governance issues. Projects involving multiple stakeholders and parties were suspected to suffer such issues. One of the informants described “*The project team consisted of those three types of people: [name of the first party], [name of the second party] and external consultants. We only have the external component as a measure of how much effort went into the project. So we captured too little data on the project itself in order for us to learn.*” Provision of the data for project evaluations was also affected by the unwillingness to inform negative reports known as the ‘mum effect’ (Smith et al. 2001), as highlighted by one of the informants “*The program delivery manager was the supplier. They did not want to give all the information to the project manager or the customer because then we knew exactly how much delay they had in their projects.*” Moreover, it appears that the process of collecting the data and reproducing it in appropriate form was time and resource consuming as stated by one of the informants “*The problem is not the insufficient data but a lack of resources; and the lack of resources gives insufficient data.*” Besides the aforementioned suggestions to use project management methods and good practice of communication, the other identified ways to cope with the issues includes forming a solid steering committee and a standardized data. One of the informants commented “*Every company and subsidiary has its own thoughts about it [the project and the data] and first you need some global rules from the head office saying this and this information is the standard one.*”

Finally, two informants underlined on the use of project management methods, such as PRINCE2 and PINO, and recommended the deployment of such methods to lessen the emergence of problems that lead to equivocal situations in project evaluations. One of the informants who experience a terminated project suggested “*Sticking to the project management method guarantees success. Write your business case. Estimate the number of people, time and resources you need. Define the desired outcome of the project. Structure the project.*”

Another informant who experience an escalated project underscored *“I am convinced that if we had used PRINCE2 as a method to run this project, we would have terminated the project in a much earlier stage. If we would have updated the business case, we would eventually see that this is not a viable business case for the rest of the project. The project manager made all the products required by PRINCE2, but they were not used the way it was meant to be.”*

7.5 Discussion

Our empirical data shows significant positive relationships between the three factors and the equivocal situations, which also confirm all the hypotheses. The result implies that the factors and the indicators within them are associated to the occurrence of equivocal situations in IS/IT project evaluations. The model demonstrates a moderate level of R^2 and an acceptable predictive relevance and performance. Conceivably, we suggest taking the indicators of these factors into account during project execution and before embarking on evaluations as high equivocality in project evaluations is suspected driving the projects to unwarranted escalation and premature termination.

The formative measurement allows for individual indicators assessment that identifies what are the salient problems within each of the factors. Distinct impacts among problems on the occurrence of equivocal situations are provided in the analysis. Positive effects of the factors mean that lessening specific problems within the suggested factors will help organizations to forestall the occurrence of equivocal situations in project evaluations.

The problems which have significant results include (1) improper planning of the project, specifically inadequately set out project milestones (CPM1); (2) improper controlling of the project, specifically inadequate control from senior management (CPM2); (3) vagueness of project charter as a basis for managing the project (CPM4); (4) difficulty in gaining a mutual perception due to different backgrounds (DFR1); (5) the lack of complementary skill and abilities among decision-makers to proceed with effective evaluations (DFR2); and, (6) unavailability of data to support the evaluations and decision-making (LED2).

However, several impacts of these problems seem diverse across distinct groups of Public versus Private sector and High ladder versus Low ladder projects. Extra attention to these specific problems should be given to projects which fall within these

groups. Hence, efforts can be focused to the specific problems to effectively forestall equivocal situations among projects within distinct groups. For instance, establishing adequate project milestones as part of project planning is of utmost importance in High ladder project compared to other problems affecting equivocal situations in project evaluations.

Findings from our post hoc interviews with the project stakeholders suggest some relevant issues for practitioners. The five pointers suggest noteworthy lessons which need to be considered to circumvent and cope with the occurrence of equivocal situations in project evaluations, such as adherence to the project management methods, good practice of communication, and developing a solid steering committee.

7.6 Conclusion

This study offers meaningful contributions to research and practice. The utilized mixed-method connects the power of quantitative findings and the strength of qualitative explanations; thus, the study gains more valuable insights (Creswell 2003). From a theoretical perspective, the study extends the relevance of decision dilemma theory and its application within the information system domain. The study contributes to the development of a model that highlights the essential factors to predict the occurrence of equivocal situations in IS/IT project evaluations.

In a practical sense, the study uncovers the salient drivers of equivocal situations. People in the project management structure and decision-makers as evaluators need to be aware of the characteristics of equivocal situations in project evaluations. To lessen the chance confronting the dilemmatic situations, this study suggests establishing a well-thought-out project management strategy. Such strategy should comprise of well-defined project milestones and project charters, and promote a strong and persistence control from top management. Commitment and involvement of top management are encouraged to ensure valuable evaluations are conducted and proper continuation decisions are taken. The findings also suggest to take into account the diversity of backgrounds, skill, and abilities of the decision-makers in order to be able to proceed with effective evaluations. Maintaining and assuring the availability of requisite data for evaluation should also lessen the chance of getting into equivocal situations.

Moreover, attention should also be given to which sector (public versus private) and which types of the IS/IT projects (high versus low project evaluation ladder) are being executed, as the impacts of each problem are varied within the two groups. It is highly important to lessen the equivocal situations when dealing with large-scale IS/IT projects in order to prevent the occurrence of rare and unpredictable events during project executions.

Limitation entailed in this study concerns with the way the data was gathered, which limits the generalizability of the results. The relatively small sample in the multi-group analysis may hamper the computation and the result as well. Thus, the need to obtain larger sample for further studies is critical to be able to generalize the findings. Moreover, further in-depth examinations on each significant problem are also warranted.

Chapter 8. Epilogue

This chapter serves as the concluding part of the thesis, which summarizes the findings, the contribution and the limitations as well as potential further research. This part starts with a recap of the research questions and how they are addressed in this thesis. Next, the contributions are presented and the limitations are discussed. This chapter ends by presenting the area that warrants further research and by stating a final remark for this thesis.

8.1 Summary of Research Findings

The main research question is:

How does equivocality manifest in IS/IT project evaluation and what is its impact on evaluation?

The sub-research questions derived from the main research question are:

1. How can equivocality be defined in IS/IT projects and what are the characteristics of an equivocal situation?
2. What are the causes of equivocal situations in IS/IT project evaluations?
3. How do equivocal situations emerge in practice?
4. How can an equivocal situation and its causes be measured?
5. What are the salient causes driving equivocal situations in IS/IT project evaluations?
6. What insights have to be taken into account by decision-makers before embarking on evaluations and making continuation decisions?

The first question “How can equivocality be defined in IS/IT projects and what are the characteristics of an equivocal situation?” is addressed particularly in Chapter 2. A systematic review is conducted by drawing upon the literature of decision-making and equivocality. Four characteristics of equivocality are identified and adapted to the context of IS/IT project evaluation. These characteristics are (1) the existence of multiple interpretations, conveyed meanings or perceptions, which lead to lack of clarity and confusion about the next course of action; (2) the indeterminacy of analyzed data to support decision-making; (3) the demand for ‘richer’ or different types of information;

and, (4) the involvement of decision-makers in reaping consensus by exchanging views and judgments through social interaction to settle disagreements. Equivocal situations in IS/IT project evaluations are described as a state whereby decision-makers or evaluators encounter a lack of clarity and confusion when deciding on the continuation of a project, which occurs when lack of knowledge or diverse knowledge exists with regard to information associated with the project, especially its past performance and future attainment. The foremost objective of an evaluation to ascertain project worthiness can be hampered by the state of the aforementioned characteristics.

The second question “What are the causes of equivocal situations in IS/IT project evaluations?” is also mainly addressed in Chapter 2. Utilizing a qualitative method and an iterative process to analyze the selected publications, eight categories of causes are formed; these are: (1) Complexity of the process; (2) Sophistication of the technology; (3) Challenges encountered in project management; (4) Lack of evaluation standards; (5) Changes in the external state; (6) Different frames of reference among decision-makers or evaluators; (7) The failure of evaluation methods; and, (8) Lack of evaluation data to support decision-making. These categories serve as a-priori causes of equivocality in IS/IT project evaluation; the delineated definitions are expanded on Chapter 2. To support the analysis and the synthesis of the literature and to refine the initial findings and framework, the proposed conceptions and framework are discussed with experts via interviews in Chapter 3. The preliminary findings from the discussion strengthen the conceptions of equivocality and its causes. The content of evaluation which includes issues in project management, complexity in the information systems development process and the sophistication of the deployed information systems is frequently mentioned by the participants. Conversely, less attention is given to the causes which are related to the issues of the evaluation criteria (Lack of evaluation standards) and the evaluation methods (the Failure of evaluation methods).

The third question “How do equivocal situations emerge in practice?” is addressed in Chapter 4. The developed framework is used to form the interview protocol and guidelines; it is tested initially in a pilot setting. The framework pulls together the characteristics of equivocal situations and the causes within evaluation frames and conveys an understanding of how equivocal situations may emerge in IS/IT project evaluation. Chapter 4 examines each project case and then cross analyses the project

cases. The main concern of practitioners when discussing why equivocal situations emerge, is the problematic nature of information in relation to project's condition or status. The information technology products or solutions which are given as the objects of an evaluation induce diverse interpretations among decision-makers because the products and benefits are inherently intangible. It is rather hard to estimate the project status and to represent a true reflection of project execution. The involved practitioners indicated in their views and opinions that the preliminary proposed elements were the causes. This forms a firm basis to develop an instrument to further measure equivocal situations as well as the causes.

The fourth the question "How can an equivocal situation and its causes be measured?" is addressed in Chapter 5. Here, the process of instrument development to measure an equivocal situation and its causes is elaborated on. The prior exploration phase provides sufficient insights and direction to form the instrument. This chapter mainly focuses on the derivation of constructs and items and the follow-up process, which comprises instrument enhancement, preparation, and application. Specifically, Q-sorting exercises, questionnaire design, and survey deployment are thoroughly described in this chapter. The instrument is subjected to qualitative and quantitative examinations resulting in a set of items for a larger survey. A preliminary model is formed to support the validity of the instrument using Partial Least Squares (PLS) analysis.

The fifth question "What are the salient causes driving equivocal situations in IS/IT project evaluation?" is addressed in Chapter 6 and all the research phases are recapped. Each cause is examined for its importance based on its path coefficient and its significance. The causes are categorized as: Content, Context, and Process (based on the developed IS/IT evaluation framework). The content of the evaluation is shown to be the salient driver of an equivocal situation; specifically, the challenges encountered in the implementation of the projects, the establishment of evaluation criteria, and the novel concepts involved in the projects. A matrix is developed to map the highly relevant causes and the potential areas which could be improved by organizations in order to lessen the occurrence of equivocal situations.

The final question "What insights have to be taken into account by decision-makers before embarking on evaluations and making continuation decisions?" is addressed partly in Chapter 6 and partly in Chapter 7. In Chapter 7, we construct an

alternative way to model an equivocal situation and its causes. The causes serve as essential factors in the prediction of the occurrence of equivocal situations in IS/IT project evaluation. The examination covers a multi-group analysis and post hoc interviews with survey respondents. The mixed-method is opted for to gain more valuable insights into the respondent answers to the questionnaire and to elaborate on respondents' experience in coping with equivocal situations. The analysis shows significant positive relationships between an equivocal situation and the causes. This result means that by lessening specific problems within the causes, organizations will be able to forestall the occurrence of an equivocal situation. Before embarking on the evaluations, decision-makers need to be aware of the emerging equivocality problems listed in Table 20. Moreover, they need to understand the different impacts of such problems on their IS/IT evaluations highlighted in Chapter 7. The multi-group analysis in Chapter 7 reveals differences in the significance of the impacts of causes between the groups: Public versus Private sector and High ladder versus Low ladder projects. The post hoc interviews also give insights into several relevant issues for practitioners on how to circumvent and deal with equivocal situations and the causes.

To consolidate the findings, we compile the results within each research phase and re-analyze the results across phases. The table below (Table 26) was developed to reconcile and visualize the similarities and differences within the results. Although the qualitative and quantitative results may not be directly comparable due to different treatments and assumptions; we can still gain invaluable insights into each of the causes of equivocal situations by considering their similarities and differences across research phases. We consolidate three tables (Table 4, Table 6, and Table 8) and convert one figure (Figure 20) from earlier chapters and then rescale the signs in a straightforward manner into a 5-point scale. Column-wise, we can see how the causal factors are determined in each step of the research.

Table 26. Analysis of causal factors across research phases

Causal factor	Literature review (N=19)	Researcher interpretation of interviews with experts (N=7)	Participants perceptions of the case studies (N=10)		PLS (N=111)
	Grounded	Dominance	Level of agreement	Level of importance	Impact
Complexity of the process	*****	++++	+++++	+++++	ns
Sophistication of the technology	**	++++	++++	++	*
Challenges in project management	*****	+++++	++++	+++++	****
Lack of standards	*	-	++	+	**
Changes in external state	***	+++	++++	++++	***
Different frames of reference	*****	++++	+	++	****
Failure of the evaluation methods	**	-	+	+	ns
Lack of evaluation data	*	+++	+++	+++	*****

In the first column of Table 26 we specify how the causal factors are grounded based on the pooled literature. This is determined by the number of selected publications. In the second column, the causal factors are the dominant causes of equivocal situations across the projects as conceived by the researcher's interpretation of the interviews with experts. This is done mainly to corroborate and complement the prior literature review as well as to serve as a triangulation of the a-priori causal factors, in which different methods and source of data are used (Kaplan and Duchon 1988). The initial result is further enriched and specified in the third column. The causal factors in the third column are conceived as the participants' perceptions of the agreement and the importance of specific factors across the different causes of equivocal situations based on the discussions with project management professionals from the case studies. The level of agreement and importance are based on a straightforward calculation on a seven-point scale conveying the participants' perception of different causal factors. The last column is a visualization of the extent of the impact of each causal factor on the occurrence of equivocal situations in project evaluations based on a quantitative analysis of the survey in the main model.

To gain interesting insights, we examine closely the causal factors and the research steps in the table. We underscore five points that warrant more elaboration. First, **Challenges in project management**, regarded as the best example of a causal factor, and is well-grounded in literature, is: noticeable in the interviews with expert, well-supported by the participants in the project case studies, and has a significant impact on the induction of equivocal situations in project evaluations according to the quantitative analysis. The same can be said of the other three causal factors, namely **Sophistication of the technology**, **Lack of standards**, and **Changes in the external state**, since they exhibit, somewhat, results that are in line with the research steps.

Challenges in project management consist of four items, indicated as problems that hinder adequate project execution. These problems, which are not necessarily related to each other, are: (1) inadequately set out project milestones; (2) inadequate control by senior management of keeping the project on track; (3) ineffective communication among people in the project management structure; and, (4) a vague project charter as a basis for project management. The second and fourth problems are shown to be significant in the quantitative analysis of the full sample. However, when

we take a closer look, the occurrences of significant problems are different across groups. Based on the significance of each problem, the inferences are formed as follows:

1. IS/IT projects conducted in the Public and Private sector encounter different problems which can lead to equivocal situations in project evaluations. IS/IT projects in the Public sector are vulnerable to problems due to: (from the lowest to the highest impact) senior management's lack of control (CPM2), ineffective communication among people in the project management structure (CPM3), and the vagueness of the project charter (CPM4). Conversely, equivocal situations when evaluating projects in the Private sector are rooted in inadequacy when setting out the project milestones (CPM1) as well as of senior management control (CPM2 – the highest impact).
2. IS/IT projects within the High and Low evaluation ladder encounter slightly different problems which can lead to equivocal situations in project evaluations. The Low ladder projects are prone to all of the indicated problems leading to an equivocal situation; inadequate senior management control (CPM2) and ineffective communication (CPM3) are shown to be the top two problems. Projects within the High evaluation ladder group only demonstrate two issues that have a significant impact on equivocal situations: inadequate control by senior management (CPM2 – the highest impact) and inadequate setting out of the project milestones (CPM1).

Second, the causes of equivocal situations, rooted in **Different frames of reference**, present an interesting point. This causal factor is well-grounded in the literature and is dominant in the interviews with the experts; however, it is not really supported by the participants in the project case studies. Yet, a further survey acknowledges this causal factor to be significant and has a substantial impact which raises the question whether practitioners are fully aware of this causal factor particularly since the process of obtaining the inference is different between project case studies and the survey. In the project case studies, the participants give their opinions as to whether the problematic situations they encountered during the evaluations (i.e., equivocal situations) are the result of the causal factors after they got the description of each causal factor and an explanation of how they are related, as postulated by the research. Conversely in the questionnaire, the proposition was not known by the survey participants; they did not know the exact connection or relation between the questions

and the construct of interest (i.e., equivocal situations). It seems that practitioners may not be fully aware of the causal factor; thus, they deemed this factor as not important and as not so influential as to induce the encountered problematic situations. They may feel that different expertise and background may improve the evaluation and clarity of the projects' status; however, these problems may arise when a clear consensus cannot be obtained through compromise and dialogue among decision-makers due to different frames of reference, especially when the decision-makers have different backgrounds and do not have complementing skills/abilities. Yet, when we take into account the significance of each item in the Different frames of reference construct across groups, the results are similar except for the Public sector group. The different backgrounds of the decision-makers (DFR1) do not make a significant contribution to the formation of the Different frames of reference construct.

Third, the causes of equivocal situations sourced from the **Lack of evaluation data** exhibit an interesting point as well. Our review of the selected literature shows limited discussion regarding this cause; however, exploration of the qualitative field studies of both the interviews with experts and the project cases studies shows that this cause appears to be a meaningful factor in causing problematic situations in project evaluations and is substantiated by the survey among project management professionals. It is possible that our chosen keywords limited the selected literature but the relation between the Lack of evaluation data and the occurrence of equivocal situations in project evaluations is something that warrants further examination. Our initial attempt is described in Chapter 7 through a post hoc examination. Bowen (1987) stresses that equivocality may emerge due to "*the unavailability of sufficient data to either fully or satisfactorily compare against those standards*" (p. 56). This appears to be a good research avenue when determining what kind of evaluation data is required and how to improve the data provision so that it will enable and support evaluation and decision-making. Moreover, when we take into account the significance of each item in the Lack of evaluation data construct across groups, the results are somewhat different. The difficulty in evaluating the project effectively due to unavailability of the needed data (LED2) is the only significant problem in the full sample; however, this is not the case for projects within the Public sector and the Low evaluation ladder groups. Projects within the Low evaluation ladder group are vulnerable to the problem of data accuracy

(LED1) rather than to the unavailability of the needed data. The impression that the evaluation data of projects within the High evaluation ladder is more difficult to construct and obtain may be due to the nature of the evaluation. It is a more experimental and judgmental process due to the imposed complexity of or the experienced implementation difficulty by the High evaluation ladder projects (Farbey et al. 1995). In addition, projects within the Public sector group are prone to problems related to the data's level of detail (LED3).

Fourth, as stated earlier, the causes of equivocal situations rooted in the **Complexity of the process** appear to firmly affect equivocal situations during project evaluations as supported by the literature review and the qualitative exploration field studies; however, the quantitative analysis deems the causes to be not significant. If we take a closer look, some interesting points are revealed from the multi group analysis (Appendix A.1). All the indicators in the Complexity of the process construct (CP1: multiple stakeholders were involved in the development process of the project, and CP2: the development process of the project involved a lot of integration with other systems) are shown to be significant, except for CP2 in the Private sector group. Significant differences between groups are also seen in CP1, that is, the impacts of CP1 are higher in the Public and Low Ladder group. Regarding the Public sector, the higher CP1 impact is considered to be typical for governmental projects that mostly involve numerous parties, such as government units (ministries, local municipalities), non-governmental organizations (NGOs), external consultants, external suppliers, etc. One of possible reasons for this occurrence is the competition among causal factors within the second-order construct (i.e., **Content**). The evaluation frames serve as the second-order construct, in which the first-order constructs (the causal factors) need to compete to make a contribution to each evaluation frame (Figure 15). Since the Complexity of the process is in the same category as the other three causal factors, its effect may be less and become insignificant due to other strong causes, e.g., the **Challenges encountered in project management**. This rational is based on Cenfetelli and Bassellier's (2009) statement: "*As the number of indicators determining a formatively measured construct is increased, the more likely it is that there will be indicators with low or even nonsignificant weights. The number of indicators has important implications for the statistical significance and, of course, the magnitude of the weights for those indicators*".

Fifth, we postulate that the utilization of evaluation methods may influence the extent of equivocality that occurs in project evaluations. In spite of this, the support for **the Failure of evaluation methods** construct is somewhat less in the qualitative field studies. This is further weakened by the non-significant result from the quantitative analysis. To take a closer look at the indicator level of the Failure of evaluation methods construct, FEM1 (i.e., a predefined procedure was applied to evaluate the project and to decide the next course of action [a reverse item]) is the only indicator that is significant in the full sample analysis and across all groups, and meaningful. The application of a predefined procedure to evaluate and decide the project's next course of action seems to be influential as a causal factor of equivocality, specifically in projects in the Private sector (highest coefficient) and in projects aiming for business transformation, a strategic system, and new service or product development (the second highest coefficient).

It is important to note that inferences based on the multi group analysis, as with many of the statistical analyses, depend mainly on the sample size, the observed R^2 and the probability level. One can provide observed powers of analysis to support the conclusions and to disclose the relevant information. For instance (Appendix A.1), the sample of 78 projects in the Private sector group with an observed R^2 of 0.47 and probability level of 0.01 gives an observed statistical power of 0.99. In comparison, the sample of 33 projects in the Public sector group with similar requirements, results in lower statistical power, i.e., 0.93.

8.2 Contributions and Implications

The thesis contributes to both theory and practice. It has implications for the research community in the IS field as well as for practitioners embroiled in IS/IT project management and evaluation. Both are described in the following sections.

8.2.1 In Research

The thesis presents an exploration of equivocality and provides empirical findings of an equivocal situation as well as its causes in IS/IT project evaluation. The major contribution of this thesis in terms of current knowledge resides in the advancement of the conception of equivocality and its causes in IS/IT project evaluation. They are grounded by theoretically linking the literature on equivocality, continuation

decisions, and IS/IT evaluation. By subscribing to Bowen's Decision Dilemma theory, this thesis extends the relevance of this theory and its application within the information system domain. Its novel construct offers a conceivable description and explanation of equivocality and the causes of equivocal situations through the emerging issues associated with IS/IT project management and evaluation. The resulting framework pulls together the characteristics of equivocal situations and the causes within evaluation frames. This thesis underscores the role of project management and evaluation on the prevailing equivocal situations. Project management has been indicated as a key factor in the improvement of project performance. Likewise, project evaluation is beneficial and is considered as a critical part of project success. The way the evaluation is employed and the way a project is managed contribute to the occurrence of equivocality when formulating continuation decisions.

Furthermore, this thesis contributes to the development of an instrument to measure equivocal situations as well as their causes and highlights the salient causes. The proposed and tested model of equivocal situations presents the mechanism and the manifestation of equivocality as well as its causes within the context of project evaluation. Thus, this thesis advances our understanding of the characteristics of equivocality in project evaluation and provides invaluable insights on how the causes of such equivocal situations can emerge in project evaluations. The proposed model represents a parsimonious categorization of equivocal situation causes, which is beneficial in deriving the conceptual explanations and predictions. This is further enriched by uncovering the distinct impacts of the causes across different groups (Public-Private sector and High-Low evaluation ladder projects). As mentioned in the previous section, the thesis uncovers noteworthy research avenues as well, such as a further examination of the needed data to improve evaluation and support for decision-making. In a methodological sense, the thesis utilizes mixed methods to gain insights into the phenomenon and to combine the strength of qualitative exploration and the power of quantitative findings. It demonstrates how the mixed-method design may be employed within the information systems discipline.

8.2.2 In Practice

In order to make project continuation decisions, such as escalation or abandonment, organizations need to be aware of equivocal situations during project evaluation. Organizations need to understand that equivocality in IS/IT project evaluation can cause unwarranted continuation and premature termination decisions. Both decisions should be circumvented at best, by lessening the degree of equivocality during IS/IT project evaluation. Following on from the aforementioned reasons, this thesis holds promise for practice as described below.

The thesis presents the characteristics of equivocal situations adapted into the IS/IT project evaluation context. These characteristics can be used by organizations; specifically, evaluators or decision-makers to gauge the states of their project evaluations, and whether equivocality has played a role. The causes of equivocal situations also need to be recognized by organizations. Understanding the causes of equivocal situations is invaluable for organizations towards their examination of the root problems which hinder project evaluations attaining the objectives, and for their purposeful decision on the next course of actions. Organizations can 'evaluate' and contemplate how they should conduct evaluations by using the suggested framework; they can examine the connection between the evaluation and the potential issues leading to equivocality in an IS/IT project evaluation.

Furthermore, the measurement developed for the equivocal situations and the causes in this thesis are constructed via several steps, adhering to scientific principles, including empirical testing. The measurement comprises of issues and problems conceived as important antecedents and indicators of the occurrence of equivocality in IS/IT project evaluation. The empirical findings indicate that the Challenges in project management, within the Content of evaluation, play the most critical role; this includes inadequate control by senior management and the vagueness of the project charter used as a basis to manage the project. Nevertheless, findings from this study should not be seen from a narrow perspective. The concern that the focus on the high-impact causes and their inherited problems per se should be higher and the way these causes emerge from different project management and evaluation issues, which then translate into problematic situations and dilemmas, need further thought as well. This should encourage practitioners to critically re-think their current practice. Consideration should

also be given to the types of organizations that are conducting the projects and the types of information systems being developed. The empirical findings show the distinct impacts on different groups of organizations and information systems; thus differing organizations have to focus differently to forestall equivocal situations. Furthermore, the discussions from post hoc interviews highlight relevance issues that should help practitioners to gain a better understanding of the mechanism of causes of equivocal situations, and to cope with such situations.

8.3 Research Limitations

In this section we discuss the limitations inherent within the two-phase design of our research despite the endeavors to conduct a rigorous study. The limitations are mentioned in the course of the research as well as the weaknesses encountered in the methods.

In relation to the exploration steps during the literature review, some prior studies may have been omitted because of the use of limited databases and particular keywords. The reason was to (1) keep the scope of the extracted literature reasonable and manageable; (2) reduce redundant and inappropriate publications; and, (3) lessen the complexity of the analysis process. Despite the selection criteria, the chosen publications are still based on the researcher's interpretation and judgment, which may have been biased. Likewise, analyses and interpretations of the common grounds of the selected publications had to be made since not every extracted publication is directly related to the IS/IT field, and particularly IS/IT projects. The relevance of the proposed categories could thus be questionable since they are derived from different contexts and one might also develop different kinds of categories as a result of the analysis.

With respect to the qualitative field studies, the interviews and the project case studies have some inherent weaknesses and limitations. The experts and the cases were recruited and selected mainly for convenience purposes although they met the established guidelines and the requirements of the research purposes. The researcher collected and analyzed the qualitative data alone, which is again biased. However, consultations and discussions with the supervisors offered different and alternative perspectives which should have lowered the bias. Naturally, participants had limitations when recalling past project evaluations and reviews. This should have been lessened by

triangulation, which includes having discussions with other participants involved in the project and obtaining related documents to support and complement the discussions. In the qualitative studies, the causes of equivocal situations seem to be interrelated and intertwined, which make it hard to determine their superiority. In addition, the project case studies were conducted in limited types of organizations, i.e., healthcare and government. Still, the use of quantitative methods in the second phase should have, to a certain extent, addressed the limitations within the overall study.

Related to the quantitative method, it is possible that the composition of the constructs and items of the model may not have been exhaustive since they were identified and derived from the prior exploration phase and thus limited to its findings. Yet, triangulation was performed through an iterative process to combine the findings from the steps within the exploration phase. Moreover, previous use of instruments to assess the equivocal situation and its causes was very limited. Due to this dearth, therefore, the instrument development involved comparing and deriving analogous constructs and items from other contexts within (e.g., information systems risks) and outside the information systems field (e.g., new product development). This is now being subjected to questions concerning the relevance and the appropriateness of the use of items derived from diverse contexts.

We believe that the various causes of equivocal situations seem to be initially interrelated and intertwined; nevertheless, we built a fairly straightforward model to predict the occurrence of equivocal situations in IS/IT project evaluations. The model should not be definitive and the specification of formative and reflective constructs is open to debate. While we are aware of the heterogeneity in our sample, the relatively small sample in the multi-group analysis may hamper the PLS computation and the result. Moreover, the utilization of PLS to analyze quantitative data is far from reaching consensus among researchers as indicated by the on-going debates and numerous pros and cons concerning the method (Henseler et al. 2014; Rönkkö and Evermann 2013). We believe the use of PLS-SEM has its limitations compared to covariance-based SEM (CB-SEM); however, we have highlighted its suitability within our research scope, i.e., for exploration and theory development (Henseler et al. 2014).

8.4 Recommendations for Future Research

This thesis sets the groundwork for further research of equivocality in IS/IT project management and evaluation. Future research is suggested, especially into the causes of equivocal situations and into the significant and the salient drivers of equivocal situations. Further in-depth examinations could be done to investigate the stories behind the existence of such problems and to reveal what has gone wrong. This could assist organizations when seeking prompt ways to disentangle the issues and to achieve valuable evaluations. While some of the problems may have been investigated generally in a different context, some other problems may warrant further examinations, specifically in the context of IS/IT project management and evaluation. For instance, it is reported that the credibility of the evaluation criteria is problematic, which contributes significantly to Lack of standards being one of the causes of equivocal situations. This opens up an opportunity for research to investigate this particular problem. Likewise, the difficulty of evaluating the projects stemming from the unavailability of evaluation data warrants further examination, e.g., what type of data and how to collect and maintain a proper stream of data adequately.

Moreover, the identified issues and problems are expected to affect project evaluations; thus, a contrary viewpoint would be: "Why are some causes not significant?" According to the quantitative part of this study, the Complexity of the process and the Failure of evaluation methods do not contribute significantly to the occurrence of an equivocal situation. Subsequent examinations can be undertaken to further clarify and improve these effects.

Another warrantable opportunity is to extend the nomological net of the proposed model. The decision dilemma theory focuses particularly on the effect of equivocality on the escalation of decisions. In an IS/IT project context, this is translated into a proposition that decision-makers will be inclined to continue the project by justifying resource addition when equivocality plays a significant role during project evaluation. Thus, extending the current model by linking the equivocal situation construct to continuation decisions will further substantiate the current conjecture. Linking it to the actual implementation of the project may also uncover the connection between equivocality and project success or failure.

Methodologically, the quantitative part may benefit from the latest improvement in the PLS, especially the correction of estimates for reflective constructs (Dijkstra and Henseler 2015). A method, which is called PLSc, offers consistent path coefficients, inter-construct correlations as well as indicator loadings, and has a comparable bias to the CB-SEM (Dijkstra and Henseler 2015).

Furthermore, future research of equivocality could also look into the literature on strategic decision-making. IS/IT projects, as part of large IS/IT investment, are considered to influence organizations since the projects may lead or change organizational direction extensively (Brown 2005). Several prominent studies have been documented in the organizational decision-making literature which propose prescriptions related to the approaches in making decisions in diverse situations (Nutt 2002). This might open up research opportunities particularly on how the decision-makers should process the evaluation, the findings, and formulate the continuation decisions.

8.5 Final Remarks

This thesis was motivated by practical conundrums of IS/IT project continuation decisions and IS/IT evaluation. The continuous interest in the phenomena and the on-going research related to the themes indicate the great concern felt by both practitioners and academics to improve the continuation decision and the evaluation. Ward (1990) advises practitioners with regard to the challenges encountered when evaluating information systems and technology:

is clearly not a simple task. It requires a combination of management perception of the overall nature of business improvements that can accrue plus realistic appraisal of each investment, to ensure that maximum benefits can be realised at an acceptable cost. At the same time, consistent criteria must be applied to both the evaluation of investments and the setting of priorities across the variety of investments (p. 230).

By embracing these challenges, the thesis endeavors to unravel the phenomenon and sets a preliminary foundation for equivocality in IS/IT project evaluation and continuation

decisions. The thesis advances the current understanding by analyzing the early empirical findings and enlightens both practitioners and academics on *equivocality* to enhance *evaluations* and *decisions*.

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Summary

In this thesis, we focus on equivocality, evaluations, and continuation decisions. The notion of equivocality highlights the challenges encountered in IS/IT project evaluations as well as the dilemma faced by decision-makers in making continuation decisions regarding projects; specifically, the evaluation at the initiation of or during project execution. Arguably, IS/IT project continuation decisions are the results of project evaluations which justify the choices of action; thus, the two themes are closely related. We connect the sub-themes of our study by subscribing to Bowen's Decision Dilemma theory, using it as the theoretical glue, bringing together the issues of equivocality, continuation decisions, and project evaluations. The theory introduces and underlines the term 'equivocal information', which applies to information with multiple (positive or negative) interpretations (Bowen 1987). Understanding the causes of equivocal situations is invaluable for organizations; to examine the root problems which hinder: (1) project evaluations in the course of attaining the objectives, and (2) informative and purposeful decisions on the next course of actions. The research objective is formulated as follows:

To understand the emergence of equivocality in evaluations, to develop a model of equivocal situation antecedents in IS/IT project evaluations, and to draw lessons learned from the findings.

This thesis aims to improve our conceptual understanding of equivocality in IS/IT project evaluations by identifying typical characteristics of equivocal situations and investigating the causes of such situations. We further develop and assess an instrument to measure an equivocal situation and its causes in project evaluations. Then, we derive a model that captures the causes of such situations; predicting the prevailing equivocal situations in the context of IS/IT project evaluations. We offer a glimpse into the emergence of equivocal situations in practice and what decision-makers can do to forestall the problematic situations. This thesis endeavors to answer the main research question:

How does equivocality manifest in IS/IT project evaluation and what is its impact on evaluation?

The following sub-research questions are derived from the main research question:

1. How can equivocality be defined in IS/IT projects and what are the characteristics of an equivocal situation? (Chapter 2)
2. What are the causes of equivocal situations in IS/IT project evaluations? (Chapter 2 and 3)
3. How do equivocal situations emerge in practice? (Chapter 3 and 4)
4. How can an equivocal situation and its causes be measured? (Chapter 5)
5. What are the salient causes driving equivocal situations in IS/IT project evaluations? (Chapter 6)
6. What insights have to be taken into account by decision-makers before embarking on evaluations and making continuation decisions? (Chapter 6 and 7)

Four characteristics of equivocality are identified and adapted in the context of IS/IT project evaluation. These characteristics are (1) the existence of multiple interpretations, conveyed meanings or perceptions, which lead to lack of clarity and confusion about the next course of action; (2) the indeterminacy of analyzed data to support decision-making; (3) the demand for 'richer' or different types of information; and, (4) the involvement of decision-makers in reaping consensus by exchanging views and judgments through social interaction to settle disagreements. Equivocal situations in IS/IT project evaluations are described as a state when decision-makers or evaluators encounter a lack of clarity and confusion when deciding on the continuation of a project, which occurs when lack of knowledge or diverse knowledge exists with regard to information associated with the project, especially its past performance and future attainment. The foremost objective of an evaluation to ascertain project worthiness can be hampered by the state of the aforementioned characteristics.

Eight cause categories that lead to equivocal situations are formed and corroborated; these are: (1) Complexity of the process; (2) Sophistication of the technology; (3) Challenges encountered in project management; (4) Lack of evaluation standards; (5) Changes in the external state; (6) Different frames of reference among

decision-makers or evaluators; (7) The failure of evaluation methods; and, (8) Lack of evaluation data to support decision-making. Hence, a framework is developed to pull together the characteristics of equivocal situations and the causes within evaluation frames, and to convey an understanding of how equivocal situations may emerge during IS/IT project evaluations.

Constructs and items are derived based on the insights obtained from the exploratory phase of the study. An instrument to measure an equivocal situation and its causes is prepared, enhanced, and applied. The causes are categorized as: Content, Context, and Process (based on the developed IS/IT evaluation framework). The Content of the evaluation is shown to be the salient driver of an equivocal situation; specifically: the challenges encountered in the implementation of the projects, the establishment of evaluation criteria, and the novel concepts involved in the projects.

A further examination of a multi-group analysis and post hoc interviews with survey respondents is done to gain more valuable insights into the respondent answers to the questionnaire and to elaborate on respondents' experience in coping with equivocal situations. The multi-group analysis reveals differences in the significance of the impacts of the causes between the groups: Public versus Private sector and High ladder versus Low ladder projects. The post hoc interviews also give insights into several relevant issues for practitioners on how to circumvent and deal with equivocal situations and the causes.

By embracing the challenges stemming from evaluating information systems and technology, the thesis endeavors to unravel the phenomenon using the empirical findings and sets a preliminary foundation for equivocality in IS/IT project evaluations and continuation decisions. Organizations can 'evaluate' how they are conducting evaluations by using the suggested framework to examine the potential issues leading to equivocality in IS/IT project evaluations. The thesis advances the current understanding and enlightens both practitioners and academics on *equivocality*, *evaluations*, and *decisions*.

Nederlandse Samenvatting

In dit proefschrift spitsen we ons toe op dubbelzinnige informatie, evaluaties en continuïteitsbeslissingen. Dubbelzinnige informatie zorgt voor uitdagingen in evaluatie van IT- en informatiesysteemprojecten en voor dilemma's bij het maken van continuïteitsbeslissingen voor projecten. Dit geldt in het bijzonder bij het opstarten of tijdens de uitvoering van het project. IS/IT project continuïteitsbeslissingen zijn het gevolg van projectevaluaties; derhalve zijn beide thema's nauw aan elkaar verwant. We brengen de sub themas van ons onderzoek met elkaar in verband door aan te haken bij Bowen's Decision Dilemma theory, waarbij we gebruik maken van de theoretische relatie tussen de aspecten dubbelzinnigheid, continuïteitsbeslissingen en projectevaluaties. De theorie introduceert en benadrukt de termen 'dubbelzinnige informatie' wat duidt op informatie die op meerdere (positieve of negatieve) wijzen kan worden geïnterpreteerd (Bowen, 1987). Het begrijpen van de oorzaken van dubbelzinnige informatie is van onschatbare waarde voor organisaties. Het is daarom van belang te de oorzaken te onderzoeken van de problemen die een belemmering vormen voor: (1) projectevaluaties tijdens het realiseren van de doelstellingen, en (2) het nemen van de juiste en goed geïnformeerde beslissingen over de te nemen acties. De onderzoeksdoelstelling is als volgt geformuleerd:

Het begrijpen van het ontstaan van dubbelzinnigheid in evaluaties, het ontwikkelen van een model van dubbelzinnige situaties die voorafgaan aan IS/IT projectevaluaties, en lessen te trekken uit de bevindingen.

Dit proefschrift richt zich op het verbeteren van ons conceptueel inzicht in dubbelzinnigheid bij IS/IT projectevaluaties door het identificeren van typische eigenschappen van dubbelzinnige situaties, en het onderzoeken van de oorzaken van zulke situaties. We ontwikkelen en evalueren een instrument om dubbelzinnige situaties en de oorzaken ervan in projectevaluaties te meten. Vervolgens leiden we een model af die de oorzaken van zulke situaties vaststelt en gebruikt kan worden voor het voorspellen van dubbelzinnige situaties in de context van IS/IT projectevaluaties. Wij bieden een eerste aanzet tot inzicht in het ontstaan van dubbelzinnige situaties in de praktijk en

geven aan wat beslissers kunnen doen om dit deze problematische situaties te voorkomen. Dit proefschrift adresseert de volgende hoofdonderzoeksvraag:

Hoe manifesteert dubbelzinnigheid zich in IS/IT projectevaluaties en wat is het effect ervan op projectevaluaties?

De volgende sub-onderzoeksvragen worden afgeleid van de hoofdonderzoeksvraag:

1. Hoe kan dubbelzinnigheid worden gedefinieerd in IS/IT projecten en wat zijn de eigenschappen van een dubbelzinnige situatie? (Hoofdstuk 2)
2. Wat zijn de oorzaken van dubbelzinnige situaties in IS/IT projectevaluaties? (Hoofdstuk 2 en 3)
3. Hoe ontstaan dubbelzinnige situaties in de praktijk? (Hoofdstuk 3 en 4)
4. Hoe kunnen we dubbelzinnige situaties en de oorzaken ervan meten? (Hoofdstuk 5)
5. Wat zijn de achterliggende oorzaken van dubbelzinnige situaties in IS/IT project evaluaties? (Hoofdstuk 6)
6. Welke inzichten moeten in acht worden genomen door de beslissers voordat evaluaties worden uitgevoerd en continuïteitsbeslissingen worden gemaakt? (Hoofdstuk 6 en 7)

Er worden vier eigenschappen van dubbelzinnigheid geïdentificeerd en aangepast aan de context van IS/IT projectevaluatie. Deze eigenschappen zijn (1) de aanwezigheid van meerdere interpretaties, gecommuniceerde strekkingen of inzichten die leiden tot gebrek aan duidelijkheid en verwarring over het te volgen traject en de te nemen acties; (2) de onzekerheid van informatie en analyses om beslissingen te ondersteunen; (3) de vraag naar 'rijkere' of verschillende types informatie; en, (4) betrokkenheid van beslissers bij het bereiken van consensus door standpunten en beoordelingen uit te wisselen en meningsverschillen bij te leggen middels sociale communicatie over en weer. Dubbelzinnige situaties in IS/IT projectevaluaties worden omschreven als een staat waarin beslissers of beoordelaars te maken hebben met een gebrek aan duidelijkheid en verwarring bij het nemen van een besluit over de voortzetting van een project. Dit vindt plaats bij een gebrek aan kennis met betrekking

tot project gerelateerde informatie, met name over de resultaten in het verleden en de toekomstige verwezenlijking. De belangrijkste doelstelling van een evaluatie om de haalbaarheid van een project vast te stellen kan worden belemmerd door bovenstaande eigenschappen.

Er worden acht oorzaakscategorieën onderscheiden en gestaafd die leiden tot dubbelzinnige situaties; deze zijn: (1) Complexiteit van het proces; (2) Geavanceerdheid van de technologie; (3) De uitdagingen waarmee het projectmanagement wordt geconfronteerd; (4) Gebrek aan evaluatiestandaarden; (5) Veranderingen in de externe omgeving; (6) Verschillende referentiekaders bij beslissers of beoordelaars; (7) Fouten in evaluatiemethoden; en, (8) gebrek aan evaluatie-informatie om de besluitvorming te ondersteunen. In het proefschrift wordt een raamwerk ontwikkeld om de eigenschappen van dubbelzinnige situaties en de oorzaken daarvan binnen evaluatiekaders samen te brengen en om inzicht te communiceren over hoe dubbelzinnige situaties kunnen ontstaan tijdens IS/IT projectevaluaties.

Het raamwerk is gebaseerd op de inzichten verkregen uit de oriënterende fase van het onderzoek. Instrumenten om een dubbelzinnige situatie en de oorzaken ervan te meten worden opgesteld, verfijnd en toegepast. De oorzaken worden gecategoriseerd in: Inhoud, Context, en Proces (gebaseerd op het ontwikkelde IS/IT evaluatieraamwerk). Aangetoond wordt dat de inhoud van de evaluatie oorzaak is van een dubbelzinnige situatie; in het bijzonder: de uitdagingen waarmee men wordt geconfronteerd bij de implementatie van de projecten, het vaststellen van de evaluatiecriteria en de nieuwe concepten die bij het project worden betrokken.

Met behulp van het raamwerk wordt verder onderzoek uitgevoerd in een multi-groep analyse. Additionele interviews met onderzoeksrespondenten zijn uitgevoerd om meer inzichten te verkrijgen in de antwoorden van de respondenten op de vragenlijst en om meer te leren over de ervaring van de respondenten in het omgaan met dubbelzinnige situaties. De multi-groep analyse laat verschillen zien tussen de groepen in de significantie van de effecten: Significante verschillen bestaan tussen publiek- versus private sectoren en tussen hoge en lage prioriteit projecten. De interviews geven ook inzicht in enkele relevante aspecten voor de praktijk om dubbelzinnige situaties en de oorzaken ervan te omzeilen en er ermee om te gaan als ze toch mochten optreden.

Door de uitdagingen die voortvloeien uit het evalueren van informatiesystemen en –technologie te overzien poogt het proefschrift om het verschijnsel te ontrafelen door gebruik te maken van de empirische bevindingen, en legt het een basis voor het analyseren van dubbelzinnigheid in IS/IT projectevaluaties en continuïteitsbeslissingen. Organisaties kunnen de manier waarop ze evalueren ‘evalueren’ door gebruik te maken van het voorgestelde raamwerk en de potentiële aspecten te onderzoeken die tot dubbelzinnigheid leiden tijdens IS/IT projectevaluaties. Het proefschrift bevordert het huidig inzicht en werpt licht op deze problematiek voor zowel de praktijk als academici.

A.2 Interview protocol

INTERVIEW PROTOCOL FOR SEMI STRUCTURED INTERVIEWS

OBJECTIVES

1. To gain insights into evaluation of IS/IT projects in the relation with equivocal situations and decision to escalate or abandon the projects.
2. To corroborate and refine the a-priori causes/antecedents identified in the literature and the prior work.
3. To elicit information needed to assist and support the design of the following survey:
 - a. Deriving the appropriate constructs.
 - b. Identifying potential evidence to form the items/indicators of the constructs (discussing indicators of constructs with experts/practitioners).
 - c. Developing models, relationships (direct causality/mediation/moderation), and proposing hypotheses.

Method: retrospective view and description from persons involved in evaluation of IS/IT development projects, e.g., Senior IS/IT manager, Project manager, User/related departmental manager, External parties.

Unit of analysis: IS/IT projects: the instances of project evaluations.

INTRODUCTION

- Appreciation for the time given for the interview.
- Overview of:
 - The study (this part and the whole).
 - The purpose of the interview.
- Informed consent form (explain and ask for signature).
- Permission to use audio recording device.
- Conditionally: recap or complete unclear part from previous interviews/discussions.

Background of the situation:

A project review or evaluation is conducted as “a process of describing the realization of resources for their merit and worth through judging and comparing a set of standards suitable for its context, followed by a decision”. During projects’ execution, you need to evaluate projects which have already been justified to ensure why you should continue supporting them. This evaluation is aimed to: (1) provide indication of the projects’ progress and likely success; (2) appraise worthiness of continuing the projects; and, (3) allow intervention to projects which deviate from their plans. The evaluation has a consequence or an outcome, i.e., decisions ranged from continuation to cancellation of the project.

Could you recall reviews/evaluations of a project that had one of these following characteristics?

1. Information provided in the review/evaluation had multiple and potentially conflicting interpretations, i.e., the information meant different things to different decision-makers.
2. Decision-makers seemed lacking clarity and understanding of the project’s condition, which created confusion concerning the project’s course of action.
3. More tangible data/information was limited and analyzing objective data was neither determinable nor effective to support decision-making.
4. It was problematic to know exactly what information was needed or how to acquire it since the condition was messy and ill-defined.
5. Multiple reasonable inferences or solutions existed in relation with the decision of the project.

We will derive and elaborate our discussion based on this chosen project. Could you first describe this project?**Project Profile**

1. What was **the decision** of the review/evaluation?
Total abandonment – Substantial abandonment/redirection – Partial abandonment/continue with reduction – Continue with additional resources – Continue as plan – Other:

2. If the project was **not abandoned**, how was/is the actual implementation of the project?
 Abandoned before completion – Never implemented – Withdrawn after implementation – Partially completed – Less than successful – Completed and successful – N/A – Other:___
3. Brief **description** of the project? (Probe: name, purpose, user, when)
 To speed-up this description, ask informant whether he/she has some documentation that describe the project (e.g., project initiation, charter, etc.)
4. Current **status** of the project?
 1. Analysis
 2. Design
 3. Development
 4. Implementation
 5. Completed
5. At the **time of evaluation**, was the project:
 1. Over budget? Y/N
 2. Behind schedule? Y/N
 3. Seems to lack of expected requirements or required specifications? Y/N
6. Compared to other IS/IT projects undertaken in your organization, what is (was) the **scale/size** of the project?
 Smaller 1 2 3 4 5 6 7 Larger
7. Compared to other IS/IT projects undertaken in your organization, what is (was) the **duration** of the project?
 Shorter 1 2 3 4 5 6 7
 Longer

GENERAL DISCUSSION

In relation to the aforementioned characteristics, from your view:

- How and why the review/evaluation had multiple (and potentially) conflicting interpretations?

- How and why there was a lack of clarity and understanding of the project's condition?
- How and why tangible or objective data/information became limited?
- How and why it was hard to know and obtain the information needed to evaluate the project?
- How and why there were multiple reasonable or satisfactory conclusions or solutions in relation with the decision of the project.

Probe:

- Which of the aforementioned characteristics had occurred? Discuss and elaborate on each condition.
- Pay attention on and briefly analyze the informant's explanations/answers; relate/cross-check them to the identified a-priori causes/antecedents.
- The upfront explanations/answers might lead to new insights or confirm the existence and the importance of the a-priori causes/antecedents.

CORROBORATING THE A-PRIORI CAUSES/ANTECEDENTS

We have identified several potential factors from literature that might affect the emergence of such situations.

Probe:

- Ask the existence of each construct by stating the working definition of the constructs; discuss and refine the constructs' definition.
- Ask the extent of agreement that the constructs influence the equivocal situation; then, how important they are? Ask for examples/instances from his/her experience.
- Elicit what aspects of the construct were important; what elements would he/she consider to form these causes; what elements that indicate these causes?
- Several questions are asked if the constructs are confirmed or existed.

CONTENT (4 CAUSES/ANTECEDENTS)

1. 'Project aspects' refer to factors related to nature and the management of IS/IT projects. This includes how projects are planned and defined in the project charter. Equivocal situations might emerge when managing the IS/IT projects, such as volatility of requirement that associated with ever changing expectations from numerous stakeholders. It is reported that lack of clear objectives, measurable goals, important assumptions, and constraints when guiding projects often leads to equivocality during project evaluations. Do you think that the project nature/management influences the chance you get into the equivocal/ambiguous situation? What elements would you consider to form this cause? What elements do you think indicate this cause? What aspects of the construct were important?

Strongly disagree 1 2 3 4 5 6 7

Strongly agree

Unimportant 1 2 3 4 5 6 7

Important

- How the project nature/management was in terms of: project planning, project specification, project estimation, and project monitoring?

Potential construct's measurement/indicators:

- To what extent the clarity of the defined **project charter**?

Not at all 1 2 3 4 5 6 7

Very great extent

- To what extent the requirements were **analyzable**?

Not at all 1 2 3 4 5 6 7

Very great extent

- To what extent the requirements were **stable**?

Not at all 1 2 3 4 5 6 7

Very great extent

- To what extent the **effectiveness of project management** in terms of planning, specification, estimation, and monitoring (or the use of PM methodology)?

Not at all 1 2 3 4 5 6 7

Very great extent

- To what extent the clarity of **perception/expectation** and **understanding** between initiators/users and developers toward the scopes/objectives of the project as well as the **resultant systems’ capabilities/limitation?**

Not at all1234567

Very great extent

2. ‘Complexity (in the process)’ is defined as intricacy in the process of developing the intended IS/IT, which may lead to difficulties in accomplishing the project. Although equivocal situations related to this factor are usually found during the development phase, the problems may be ‘imported’ into project evaluation. Complexity in the process may be amplified by the interdependencies among project tasks that require higher levels of coordination. Developing system that operate or connect to a large number of different systems, either intra- or inter-organizations, may also face this kind of problem. Do you think the Complexity influences the chance you get into the equivocal/ambiguous situation? What elements would you consider to form this cause? What elements do you think indicate this cause? What aspects of the construct were important?

Strongly disagree1234567

Strongly agree

Unimportant1234567

Important

- How was the complexity of the process when developing the IS/IT project?

Potential construct’s measurement/indicators:

- Compared to other IS/IT projects undertaken in your organization, how is (was) the **number of people/departments/organizations involved in the project?**

Small number1234567

Large number

Intra-departmental/organizational

1234567

Inter-departmental/organizational

- Compared to other IS/IT projects undertaken in your organization, how is (was) the **complexity** of the project?

Much less complex 1 2 3 4 5 6 7

Much more complex

3. ‘Sophistication (of the technology)’ is defined as difficulty in defining and adopting the intended IS/IT investment. Equivocal situations occur when the initiators, users, and the developers deal with new/high technology or innovative projects, in which they might lack sufficient knowledge or experience. Do you think the Sophistication influences the chance you get into equivocal/ambiguous situation? What elements would you consider to form this cause? What elements do you think indicate this cause? What aspects of the construct were important?

Strongly disagree 1 2 3 4 5 6 7

Strongly agree

Unimportant 1 2 3 4 5 6 7

Important

- How was the advancement/sophistication of the intended IS/IT (which the project was aiming for)?

Potential construct’s measurement/indicators:

- Which of the following best describe the **primary purpose** of the project?
 1. Business transformation
 2. Strategic systems
 3. New service or product development
 4. Inter-organizational systems
 5. Infrastructure
 6. MIS and DSS
 7. Direct value added systems
 8. Automation
 9. Mandatory changes

Alternative categories:

1. ‘Transformate’: to provide a competitive advantage
2. ‘Informate’: to provide information for planning and decision-making

3. 'Automate': to capture and process data related to routine organizational transactions

- Compared to other IS/IT projects undertaken in your organization, how is (was) your **organization experience** related to the project?

No innovation involved in the project

1 2 3 4 5 6 7

The project is (was) completely innovative in nature; never attempted before

- To what extent the project involved **innovation/new idea(s)** or **technology(ies)** that have not been used/developed before?

Not at all 1 2 3 4 5 6 7

Very great extent

- Do you have a (formal) procedure or guideline to conduct evaluation? How was the procedure? Do you think the procedure or the guideline influences the chance you get into the equivocal/ambiguous situation? What elements would you consider to form this cause? What elements do you think indicate this cause? What aspects of the construct were important?

4. 'Standards' refer to the difficulty in establishing credible criteria to evaluate and pinpoint the worthiness of continuing the projects. Decision-makers might experience insufficient knowledge to determine what or which criteria are important to evaluate and to ascertain the projects. The condition is also induced by organizations' vague criteria of success and failure. Do you think the Criteria/Standard influences the chance you get into equivocal/ambiguous situation? What elements would you consider to form this cause? What elements do you think indicate this cause? What aspects of the construct were important?

Strongly disagree 1 2 3 4 5 6 7

Strongly agree

Unimportant 1 2 3 4 5 6 7

Important

- How did you evaluate the projects? In terms of evaluative criteria establishment/generation?

- What are the included criteria for the evaluation?
- How do you choose these criteria?
- Why do you choose particular criteria?
- How the success/fail criteria have been defined in the project charter?
- Elaboration and opinion about the criteria establishment/generation and their usage.

Potential construct's measurement/indicators:

- To what extent the used criteria were **plausible** to show past performance of the project?

Not at all	1	2	3	4	5	6	7
Very great extent							
- To what extent the used criteria were **reliable** to show the future attainment of the project?

Not at all	1	2	3	4	5	6	7
Very great extent							
- To what extent the decision-makers **agreed** or **reached consensus** to use the criteria?

Not at all	1	2	3	4	5	6	7
Very great extent							

CONTEXT (2 CAUSES/ANTECEDENTS)

5. 'Frames of reference' refer to the existence of diverse viewpoints that were used to interpret particular situations. Varying interests and functional background among different departments as well as interdepartmental relations may be the backdrop of the occurrence of equivocal situations. This factor is also induced by the issues related to project team members, such as new members entering the project at later stages or personal conflicts. Do you think the Frame of reference influences the chance you get into equivocal/ambiguous situation? What elements would you consider to form this cause? What elements do you think indicate this cause? What aspects of the construct were important?

Strongly disagree	1	2	3	4	5	6	7
Strongly agree							
Unimportant	1	2	3	4	5	6	7
Important							

- Who decide the continuation or cancellation of the IS/IT project?
Probe: one-person/a key/primary decision-maker(s)/a team-like decision?
What is the function of this (these) person(s)?

- How was the involvement of other decision-makers in the evaluation?

Potential construct's measurement/indicators:

- To what extent the **heterogeneity** of decision-makers in terms of their **functional backgrounds**?

Not at all	1	2	3	4	5	6	7
Very great extent							

- To what extent **different stakeholders** were involved in making final decisions?

Not at all	1	2	3	4	5	6	7
Very great extent							

- To what extent the frequency of fresh people or **new members** entering the project during project execution?

Not at all	1	2	3	4	5	6	7
Very frequent							

- To what extent the different viewpoints of **senior management** have **intervened** the project? (if applicable)

Not at all	1	2	3	4	5	6	7
Very frequent							

6. 'Environmental/external state' refers to the environmental dynamic of organizations. This factor is related to the organizations' view on the invested IS/IT, such as to keep them up with the competition or to fulfil the organizational needs. It is related, for instance, to technological/business requirement trends as well as the favorability of business condition. Do you think the Environmental/External state influences the chance you get into equivocal/ambiguous situation? What elements

would you consider to form this cause? What elements do you think indicate this cause? What aspects of the construct were important?

Strongly disagree 1 2 3 4 5 6 7

Strongly agree

Unimportant 1 2 3 4 5 6 7

Important

- How was the dynamic of external environment in relation to the IS/IT project?

Potential construct's measurement/indicators:

- To what extent the project was highly influenced by **favorability of business condition**?

Not at all 1 2 3 4 5 6 7

Very great extent

- To what extent the project was critical to keep the organization up with the **technological/business requirement trends** or with **competitors** (which use comparable technology/systems)?

Not at all 1 2 3 4 5 6 7

Very great extent

- To what extent the importance of **having the latest technology/systems** that the project strived to deliver?

Not at all 1 2 3 4 5 6 7

Very great extent

- To what extent the project was influenced by the **dynamic of external environment** such as corporate politics, restructuring, or changes in organizational management?

Not at all 1 2 3 4 5 6 7

Very great extent

PROCESS (2 CAUSES/ANTECEDENTS)

7. 'Methods' refer to the use of techniques and tools by decision-makers to evaluate the projects. Equivocal situations may emerge when decision-makers fail to compare the evaluation data to a set of criteria. This condition is interpreted as disability to

utilize a comparing process. The comparison typically involves particular techniques and tools to assist decision-making. Limitations of such methods have been indicated as the potential cause of equivocal situation. Do you think the utilization of evaluation techniques and tools influences the chance you get into equivocal/ambiguous situation? What elements would you consider to form this cause? What elements do you think indicate this cause? What aspects of the construct were important?

Strongly disagree 1 2 3 4 5 6 7
Strongly agree

Unimportant 1 2 3 4 5 6 7
Important

- How did you evaluate the projects in terms of evaluation techniques/tools utilization?
- What were the utilized techniques and tools to evaluate the project?
- How did you choose these (this) technique(s) and tool(s)?
- Why did you choose these (this) particular technique(s) and tool(s)?
- Elaboration and opinion about the usage of techniques and tools.

Potential construct's measurement/indicators:

- To what extent the data/information from different sources can be **aggregated** or **compared without inconsistencies** by using the method(s)?

Not at all 1 2 3 4 5 6 7
Very great extent

- To what extent the improvement of your ability to make **good and enhanced decisions** by using the method?

Not at all 1 2 3 4 5 6 7
Very great extent

- To what extent the method(s) is (are) **uncomplicated** to use and the analysis was **clear** or **easy to interpret**?

Not at all 1 2 3 4 5 6 7
Very great extent

8. 'Data/Information' refers to the use of data surrounding the projects to support decision-making. The unavailability of sufficient data in terms of types, quantity, and quality may hinder decision-makers to assert the projects progress and future attainment. It is reported that validity and reliability of information surrounding the projects may induce equivocality. It is also indicated that the information on projects past performance may contribute to equivocality. Do you think the use of data/information influences the chance you get into equivocal/ambiguous situation? What elements would you consider to form this cause? What elements do you think indicate this cause? What aspects of the construct were important?

Strongly disagree	1	2	3	4	5	6	7
-------------------	---	---	---	---	---	---	---

Strongly agree

Unimportant	1	2	3	4	5	6	7
-------------	---	---	---	---	---	---	---

Important

- How did you evaluate the projects in terms of making sense of the project/organizational data?
- What kind of data did you use to support your project evaluation?
- How did you choose/decide which data is needed to be provided?
- Why did you choose particular data?
- Elaboration and opinion about the usage and the provision of organization/project data.

Potential construct's measurement/indicators:

- To what extent the **problems of accuracy** occurred in the provided data/information?

None	1	2	3	4	5	6	7
------	---	---	---	---	---	---	---

Numerous

- To what extent the elements of the data/information are either **obvious or easy to find**?

Unproblematic	1	2	3	4	5	6	7
---------------	---	---	---	---	---	---	---

Problematic

- To what extent the **understandability** of the provided data/information?

Not at all 1 2 3 4 5 6 7
 Very great extent

- To what extent the data **fulfils the needed basic fields/elements**?

Not at all 1 2 3 4 5 6 7
 Very great extent

- To what extent the data was at the **right level** or at the **right level of detail**?

Not at all 1 2 3 4 5 6 7
 Very great extent

- To what extent the **validity** and the **reliability** of the provided data/information?

Unrepresentative 1 2 3 4 5 6 7
 Valid
 Inconsistent 1 2 3 4 5 6 7
 Reliable

OVERALL EVALUATION

1. The overall **review/evaluation** process was:

Satisfying 1 2 3 4 5 6 7
 Unsatisfying
 Straightforward 1 2 3 4 5 6 7
 Complicated

2. The **decision which is made** based on the review/evaluation was:

Satisfying 1 2 3 4 5 6 7
 Unsatisfying
 Straightforward 1 2 3 4 5 6 7
 Complicated

3. The **information which you used** for decision-making was:

Complete 1 2 3 4 5 6 7
 Incomplete
 Convinced 1 2 3 4 5 6 7
 Unconvinced

Clear	1	2	3	4	5	6	7
Ambiguous							

4. In order to review/evaluate and to decide the project's next course of action, the **knowledge of decision-makers** was:

Sufficient	1	2	3	4	5	6	7
Insufficient							

Converge	1	2	3	4	5	6	7
Diverge							

EXPERIENCE

1. Based on your experience, how often do you find such situations (i.e., equivocal situations, dilemmas) when evaluating your IS/IT projects?

Rarely	1	2	3	4	5	6	7
Frequently							

2. Based on your own experience and knowledge, how were the courses of actions usually decided in such situations?

Lean toward abandoning/closing the project

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Lean toward escalating/continuing the project

WRAP UP THE INTERVIEW

- Do you have any remarks which you would like to mention concerning the causal factors of equivocal situations that have not been covered or discussed?
- Do you have any additional remarks concerning our discussion that relevant for this study?

INTERVIEWEE PROFILE

- Do you have any direct personal responsibility in initiating the project? Yes/No
- Could you describe your formal position and your area of responsibility within the organization?

[] Senior manager of ____

[] Project manager

[] Non-IS/IT manager (e.g., marketing, finance, etc.)

☐ Other:

In the project?

☐ Corporate or program management

☐ Project Board

☐ Project Management

☐ Project Delivery Team

☐ Other:

3. In which industry does your organization reside in?

List of industry

Aerospace

Agriculture

Automotive

Banking Financial Services

Chemicals

Construction and Engineering

Consumer Services

Distribution and Logistics

Education

Electronics

Energy and Mining

Food Processing

Government

Healthcare

High Tech

Hospitality/Restaurants

Insurance

IT and Software Retail

IT Services

Legal Transportation

Manufacturing

Media

Non-Profit

Pharmaceuticals

Professional Services

Telecommunications

Utilities

Other:

4. The size of your organization in terms of:

Net revenue: _____ €M/year

Total employees: _____ FTE

5. The percentage of IS/IT department's budget to the net revenue (if applicable):

_____ %

6. How long have you been working?

For the organization:

☐ 1 – 5

☐ 5 – 10

☐ >10

A.3 Screenshot (information about the research, the initial survey, and the main survey)

Purposeful Project Evaluation/Review & Illustration from PM Methodology

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- During projects' execution, you need to evaluate projects which have already been justified to ensure why you should continue supporting them. This evaluation is aimed to: (1) **provide indication of the projects' progress and likely success**; (2) **appraise worthiness of continuing the projects**, and; (3) **allow intervention to projects which deviate from their plan**. The evaluation has a consequence or an outcome, i.e. decisions ranged from **continuation** to **cancellation** of the project.
- For instance, the use of **PRINCE2** methodology to manage a project requires the "Controlling a Stage and Managing Product Delivery" as one of the Project Management processes.

Focal Issue

PRINCE2 Controlling a Stage (Great Britain, Office of Government, 2005)

PRINCE2 Six Area of Control (reproduced from Graham, 2010)

- In this phase, several **activities need to be taken**, such as Assessing Progress, Capturing and Examining Project Issues, Reviewing Stage Status, etc.

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- **Areas or aspects**, which typically analyse to provide indication of the projects' progress and likely success as well as to appraise worthiness of continuing the projects, typically cover the **Cost, Benefit, Risk, Time, Quality, and Scope**.

Introduction questionnaire

- The questionnaire is aimed mainly to explore ambiguous condition prevailed when reviewing/evaluating different areas/aspects with particular methods.
- Could you share your experience in managing and reviewing/evaluating your IS/IT projects through a questionnaire?
- It will take around 10 minutes of your time to complete the questionnaire.
- Please click the link below to start:
- <http://tinyurl.com/riebs2012> (open a new window).
- Thank you for participating.

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Research IEBIS

*Required

General

Your general experience in managing IS/IT projects.

1. **Do you use a particular methodology in managing your IS/IT projects, such as PRINCE2, MSP, or PMBOK? ***

(PRINCE2: PProjects IN Controlled Environments) (MSP: Managing Successful Programmes)
(PMBOK: Project Management Body of Knowledge)

Mark only one oval.

- ☐ Yes
☐ No
☐ Sometimes

2. **Could you please elaborate on your answer?**

3. **Do you review your on-going projects (e.g. as suggested by the Project Management Methodology)? ***

Mark only one oval.

- ☐ Yes
☐ No
☐ Sometimes

4. **Could you please elaborate on your answer?**

Guidance

Could you recall one review/evaluation of a challenged IS/IT project? Please keep this one project in mind through the questionnaire.

Please indicate profile of the project as well as your experience during the review/evaluation (e.g. meetings or formal discussion) of this project by choosing the appropriate answers below.

Project's Profile

5. What was the decision of the review/evaluation? *

Mark only one oval.

- ☐ Total abandonment
- ☐ Substantial abandonment/redirection
- ☐ Partial abandonment/continue with reduction
- ☐ Continue with additional resources
- ☐ Continue as plan
- ☐ Other: _____

6. If the project was not abandoned, how was/is the actual implementation of the project?

Mark only one oval.

- ☐ Abandoned before completion
- ☐ Never implemented
- ☐ Withdrawn after implementation
- ☐ Partially completed
- ☐ Less than successful
- ☐ Completed and successful
- ☐ Not applicable
- ☐ Other: _____

7. Which of the following is best described as the primary purpose of the project? *

Mark only one oval.

- ☐ Business transformation
- ☐ Strategic system
- ☐ New service or product development
- ☐ Inter-organisational system
- ☐ Infrastructure
- ☐ MIS and DSS
- ☐ Direct value added system
- ☐ Automation
- ☐ Mandatory changes
- ☐ Other: _____

8. Could you please provide a brief description of the chosen project?

Evaluation Areas/Aspects, Methods and Decision-makers

Reviewing/evaluating the on-going projects typically involves a range of stakeholder such as initiators, evaluators, users as well as other interested parties (especially considerable large or strategic ones). For instance, senior managers, project managers and functional managers can be involved when reviewing/evaluating and deciding about the projects' course of action.

During this process, several methods or techniques and tools can be used in practice to evaluate the project (e.g. cost benefit analysis, pricing model, information economics, Bedell's method, risk handling, value analysis, etc.).

Please share your experience for the challenged project you have in mind.

Cost

9. To what extent did the decision-makers have different interpretations toward information provided in the review/evaluation concerning costs? *

Mark only one oval.

[illegible]

10. **More than one reasonable or satisfactory conclusion resulted from reviewing/evaluating costs**

Mark only one oval.

[illegible]

11. How problematic was it to know exactly what information was needed when reviewing/evaluating costs? *

Mark only one oval.

[illegible]

12. **Did you use a particular method or technique and tool for reviewing/evaluating costs? ***

Mark only one oval.

- ☐ Yes
☐ No
☐ Not applicable/Do not know

13. **If Yes, what is the name(s) of the method/tool(s) you used?**

Benefit

14. **To what extent did the decision-makers have different interpretations toward information provided in the review/evaluation concerning benefits? ***

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	☐	☐	☐	☐	☐	☐	☐	Very great extent

15. **More than one reasonable or satisfactory conclusion resulted from reviewing/evaluating benefits? ***

Mark only one oval.

	1	2	3	4	5	6	7	
Completely untrue	☐	☐	☐	☐	☐	☐	☐	Completely true

16. **How problematic was it to know exactly what information was needed when reviewing/evaluating benefits? ***

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	☐	☐	☐	☐	☐	☐	☐	Very problematic

17. **Did you use a particular method or technique and tool for reviewing/evaluating benefits? ***

Mark only one oval.

- ☐ Yes
☐ No
☐ Not applicable/Do not know

18. **If Yes, what is the name(s) of method/tool(s) you used?**

Risk

19. To what extent did the decision-makers have different interpretations toward information provided in the review/evaluation concerning risks? *

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	☐	☐	☐	☐	☐	☐	☐	Very great extent

20. More than one reasonable or satisfactory conclusion resulted from reviewing/evaluating risks *

Mark only one oval.

	1	2	3	4	5	6	7	
Completely untrue	☐	☐	☐	☐	☐	☐	☐	Completely true

21. How problematic was it to know exactly what information was needed when reviewing/evaluating risks? *

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	☐	☐	☐	☐	☐	☐	☐	Very problematic

22. Did you use a particular method or technique and tool for reviewing/evaluating risks? *

Mark only one oval.

- ☐ Yes
☐ No
☐ Not applicable/Do not know

23. If Yes, what is the name(s) of method/tool(s) you used?

Respondent Profile

24. **Could you please describe your current formal position and area of responsibility in the organisation? ***

Mark only one oval.

- ☐ Senior manager of IS/IT - CIO
- ☐ Senior manager of non IS/IT
- ☐ IS/IT manager
- ☐ Non IS/IT manager (e.g. marketing, finance, etc.)
- ☐ Project manager (e.g. in projectised organisations)
- ☐ Other: _____

25. **In the project? ***

Mark only one oval.

- ☐ Corporate or programme management
- ☐ Project Board
- ☐ Project Management
- ☐ Project Delivery Team
- ☐ Other: _____

26. Which industry does your organisation belong to? *

Mark only one oval.

- ☐ Aerospace
☐ Agriculture
☐ Automotive
☐ Banking
☐ Chemicals
☐ Construction and Engineering
☐ Distribution and Logistics
☐ Consumer Services
☐ Education
☐ Electronics
☐ Energy and Mining
☐ Financial Services
☐ Food Processing
☐ Government
☐ Healthcare
☐ High Tech
☐ Hospitality/Restaurants
☐ Insurance
☐ IT and Software
☐ IT Services
☐ Legal
☐ Manufacturing
☐ Media
☐ Non-Profit
☐ Pharmaceuticals
☐ Professional Services
☐ Retail
☐ Telecommunications
☐ Transportation
☐ Utilities
☐ Other

27. What country do you reside in?

28. For how long you have been working? (in years) *

Mark only one oval per row.

	1 to 5	5 to 10	more than 10
At your organisation?	☐	☐	☐
In the industry?	☐	☐	☐

Introduction to the next study

This is an initial survey which is conducted as part of a larger study on escalation and abandonment. Objective of the study is to understand escalation and abandonment phenomena and to improve the decision and evaluation of IS/IT Projects. The subsequent study will design a framework to forestall the phenomena and how to handle vulnerable situations that typically lead to unwarranted escalation and premature abandonment. This study will:

- Focus on how organisations evaluate their IS/IT projects and how decisions are made in dilemmatic situations
- Be interested on the involvement of the decision-makers (e.g. Project Board, Project Manager) and how they are confronted with dilemmas when deciding go-no-go decisions of IS/IT projects
- Be interested on what inform organisations when deciding course of action of the projects

By participating the subsequent study, you can request a report on:

- How other organisations deal with the evaluation (insight on the use of evaluative criteria as well as the use of different techniques and tools)
- How other organisations have experienced in evaluating and making the decisions
- How to enhance your IS/IT projects decision-making by lessen unwarranted escalation and avoid premature abandonment

29. Would you like to be contacted for further study? *

Mark only one oval.

- ☐ Yes
☐ No

30. If Yes, could you please provide your name, email or phone number?

Thank you for your participation!

Arviansyah
Department of Industrial Engineering and Business Information Systems
University of Twente
Email: a.arviansyah@utwente.nl
Phone: +31534892350

Please click the Submit button and wait for the confirmation page to assure your responses are recorded

Research conducted by Department of Industrial Engineering and Business Information Systems

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[illegible]

- Mark only one oval.

1 2 3 4 5 6 7

Strongly disagree ○ ○ ○ ○ ○ ○ Strongly agree

- Mark only one oval.

[illegible]

- Mark only one oval.

[illegible]

- Project charter: the rationale of why a project needs to be conducted, what are the project goals and how the project will be accomplished

Mark only one oval.

[illegible]

Could you please describe the use of criteria to evaluate the project?

- Mark only one oval.

[illegible]

- Mark only one oval.

[illegible]

- Mark only one oval.

[illegible]

Could you please describe how the external environment had affected the project?

- Mark only one oval.

[illegible]

- Mark only one oval.

[illegible]

- Mark only one oval.

[illegible]

- Mark only one oval.

[illegible]

Could you please describe the decision-makers who evaluated the project?

- Mark only one oval.

[illegible]

- Mark only one oval.

[illegible]

- Mark only one oval.

[illegible]

Could you please describe the use of techniques/method to evaluate the project?

- Mark only one oval.

[illegible]

- Mark only one oval.

[illegible]

Could you please describe how the data surrounding the project was used in the evaluation?

- Mark only one oval.

[illegible]

- Mark only one oval.

1 2 3 4 5 6 7

Strongly disagree Strongly agree

26. **The data were at an appropriate level of detail to evaluate the project ***

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	☐	☐	☐	☐	☐	☐	☐	Very great extent

Situation surrounding the evaluation

Could you please describe the setting in which the evaluation took place (e.g., meetings or formal discussion)?

To what extent the characteristics below were prevailed?

27. **The project status or condition was hard to ascertain caused by different interpretations among decision-makers toward information surrounding the project ***

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	☐	☐	☐	☐	☐	☐	☐	Very great extent

28. **Decision-makers lacked clarity and understanding of the condition of the project and thus were confused concerning the next course of action ***

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	☐	☐	☐	☐	☐	☐	☐	Very great extent

29. **It was problematic to analyse the condition of the project since insufficient objective data was available to base the decisions on ***

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	☐	☐	☐	☐	☐	☐	☐	Very great extent

30. **Decision-makers needed to exchange opinions, share meanings and beliefs toward the project to settle disagreement and reach consensus for the next course of action ***

Mark only one oval.

	1	2	3	4	5	6	7	
Not at all	☐	☐	☐	☐	☐	☐	☐	Very great extent

Decision and actual implementation

31. What was the decision of the review/evaluation? **Mark only one oval.*

- ☐ Total abandonment
- ☐ Substantial abandonment/redirection (major truncation, differ substantially from original spec.)
- ☐ Partial abandonment/continue with reduction (less changes from original specification)
- ☐ Continue with additional resources (e.g., time, money, working team)
- ☐ Continue as planned
- ☐ Other:

32. If the project was not abandoned, how was/is the actual implementation of the project? **Mark only one oval.*

- ☐ Eventually abandoned before completion
- ☐ Never implemented
- ☐ Withdrawn after implementation
- ☐ Partially completed
- ☐ Less than successful
- ☐ Completed and successful
- ☐ Not applicable
- ☐ Other:

Project profile**33. Which of the following is best described as the primary purpose of the project? ****Mark only one oval.*

- ☐ Business transformation
- ☐ Strategic system
- ☐ New service or product development
- ☐ Inter-organisational system
- ☐ Infrastructure
- ☐ MIS and DSS
- ☐ Direct value added system
- ☐ Automation
- ☐ Mandatory changes
- ☐ Other:

34. Which of the following is best described as the type of your project? *

Mark only one oval.

- ☐ In-house new development
- ☐ Packaged software implementation
- ☐ Enhancement of existing software
- ☐ Not applicable
- ☐ Other: _____

35. At the time of evaluation, was the project? *

Mark only one oval per row.

	Yes	To a certain extent	No
Over budget	☐	☐	☐
Behind schedule	☐	☐	☐
Seems to lack of expected requirements or required specifications	☐	☐	☐

36. Compared to other IS/IT projects undertaken in your organisation, what is (was) the scale/size of the project? *

e.g., in term of money, resources involved

Mark only one oval.

	1	2	3	4	5	6	7	
Smaller	☐	☐	☐	☐	☐	☐	☐	Larger

37. Compared to other IS/IT projects undertaken in your organisation, what is (was) the duration of the project? *

Mark only one oval.

	1	2	3	4	5	6	7	
Shorter	☐	☐	☐	☐	☐	☐	☐	Longer

Your profile

38. Could you please describe your current formal position and area of responsibility in the organisation? *

Mark only one oval.

- ☐ Senior manager of IS/IT - CIO
- ☐ Senior manager of non IS/IT
- ☐ IS/IT manager
- ☐ Non IS/IT manager (e.g., marketing, finance, etc.)
- ☐ Project manager (e.g., in projectised organisations)
- ☐ Other: _____

39. In the project? **Mark only one oval.*

- ☐ Corporate or programme management
- ☐ Project Board
- ☐ Project Management
- ☐ Project Delivery Team
- ☐ Other: _____

40. Which industry does your organisation belong to? **Mark only one oval.*

- ☐ Aerospace
- ☐ Agriculture
- ☐ Automotive
- ☐ Banking Financial
- ☐ Services
- ☐ Chemicals
- ☐ Construction and Engineering
- ☐ Consumer Services
- ☐ Distribution and Logistics
- ☐ Education
- ☐ Electronics
- ☐ Energy and Mining
- ☐ Food Processing
- ☐ Government
- ☐ Healthcare
- ☐ High Tech
- ☐ Hospitality/Restaurants
- ☐ Insurance
- ☐ IT and Software Retail
- ☐ IT Services
- ☐ Legal Transportation
- ☐ Manufacturing
- ☐ Media
- ☐ Non-Profit
- ☐ Pharmaceuticals
- ☐ Professional Services
- ☐ Telecommunications
- ☐ Utilities
- ☐ Other

41. What is the relative size of your organisation within the industry? *

e.g., in term of revenue, FTE, etc.

Mark only one oval.

- ☐ Small (smaller than average)
- ☐ Medium (on average)
- ☐ Big (larger than average)

42. For how long have you been working? (in years) *

Mark only one oval per row.

	1-5	5-10	more than 10
At your current organisation	☐	☐	☐
In the industry	☐	☐	☐

43. What country do you reside in? *

Wrap up questions

44. Would you like to help us further by discussing your responses of this questionnaire? *

Mark only one oval.

- ☐ Yes
- ☐ No

45. Would you like to provide your name, email or phone number?

it is also needed if you wish to receive a summary of the results of this study

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Ministry of Research, Technology
and Higher Education
Republic of Indonesia

This thesis is motivated by the practical conundrums encountered when making information systems and technology (IS/IT) project continuation decisions and by the dearth of research pertaining to the causes of equivocality in IS/IT project evaluations. Despite the paucity of studies dealing with this theme, there is great concern among both practitioners and academics that continuation decisions and the evaluations need to be improved. To enrich our conceptual understanding of equivocality in IS/IT projects, this thesis identifies typical characteristics and causes of equivocal situations. It delineates the development and assessment of an instrument to measure an equivocal situation and its causes, providing insights into the emergence of this situation. This thesis endeavors to unravel the phenomenon of equivocality and to set a preliminary foundation of equivocality in IS/IT projects. It enlightens both practitioners and academics by suggesting how problems in project evaluations can be forestalled and by advancing the knowledge on equivocality, evaluations, and decisions.

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